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THE DIAGNOSIS AND SURGICAL TECHNIQUE TO BE EMPLOYED IN THE HANDLING OF ACUTE ABDOMINAL CONDITIONS, ILLUSTRATING MANY INTERESTING POINTS IN DIAGNOSIS AND TECHNIQUE WITH ORIGINAL DRAWINGS[1]

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I WOULD indeed be lacking in gratitude if I failed to express to the fellows of the Southern Surgical and Gynecological Association my deep appreciation of the great honor conferred upon me in electing me to the highest office within your gift. Until quite recently it was my intention to follow the usual custom on such occasions, and to deliver to you a general address, but after reading and re-reading the masterful oration of my distinguished predecessor, Dr. J. M. T. Finney, delivered at the last meeting of this association, and hearing his equally scholarly address at the recent meeting of the American College of Surgeons in Chicago, it seems to me that the subject matter usually covered in such addresses has been exhausted — at least for a time.

I, therefore, trust that you will pardon me if I depart from the usual rule and present to you a subject of my own selection; namely, the diagnosis and surgical technique to be employed in the handling of acute abdominal conditions, illustrating many interesting points in diagnosis and technique with original drawings. Under this head, I shall consider —

First. Gunshot and stab wounds of the abdomen.

Second. Injuries to abdominal viscera, resulting from severe abdominal contusions.

Third. Acute intestinal obstruction.

I have selected the above-mentioned subjects for the reason that they constitute a distinct group of acute abdominal conditions where immediate operative treatment is mandatory, the mortality depending upon the time of operation and the technique employed.

With the exception of the last subject, acute intestinal obstruction, few individual operators have had the opportunity to draw conclusions from a large series of cases to be treated under the first two headings, namely, gunshot and stab wounds of the abdomen, and severe abdominal contusions. I, therefore, will present in detail certain points in the diagnosis and technique of this work which I have found of value in the handling of a large number of such injuries. I shall then take up some important technical methods which I have found of value in dealing with the equally serious pathology resulting from acute intestinal obstruction.

[1]President's Address read before the Southern Surgical and Gynecological Association, December 17, 1913, Atlanta, Georgia.

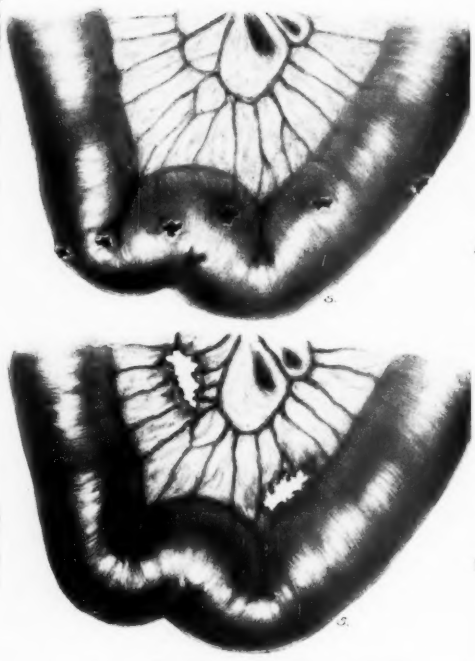

Fig. 1. A, Multiple gunshot wounds of the small bowel. Patient suffering a fatal injury with no immediate symptoms indicating the seriousness of the injury. B, Multiple gunshot wounds of mesentery. Patient suffering fatal injury with immediate symptoms of hæmorrhage and shock.

GUNSHOT AND STAB WOUNDS OF THE ABDOMEN

Classification. Gunshot and stab wounds of the abdomen may be classified under three heads:

1. The simple penetrating wound, or a wound where the knife or bullet penetrates the peritoneal cavity without injury to abdominal viscera.

2. Penetrating and perforating wounds, or wounds where the knife or bullet penetrates the peritoneal cavity and injures either solid or hollow viscera, or both.

3. Complicated wounds, or wounds in which the entrance to the abdominal cavity is made by knife or bullet through chest, pleura, and diaphragm with or without injury to abdominal viscera.

Diagnosis. It is at times exceedingly difficult to differentiate between the simple penetrating wound and the penetrating and perforating wound. I have time and again operated on a patient whose abdomen has been penetrated by a bullet with both a wound at entrance and exit, where no damage to peritoneal viscera was found when the abdomen was opened and careful search for perforations was made. Such wounds give few or no symptoms. Again, I have operated on many cases in which there were present no symptoms indicating the serious nature of the injury for the reason that the patient was not bleeding, as the perforations were in the "bloodless" portion of the bowel.

Fig. 1 illustrates the difficulties encountered in differentiating between the two types of wounds. The simple perforating wound is the type of wound that the military surgeon often reports as recovering from undoubted multiple bowel injuries, without operation. The civil surgeon recognizes that there is no method of telling whether injury to hollow viscera has occurred, unless perforations are demonstrated by means of an abdominal section and careful search. I, therefore, seriously question the diagnosis in the reported recoveries from such injuries under the expectant plan of treatment.

In the penetrating and perforating wounds giving no alarming symptoms, delay in exploring is the usual rule, and when the exploration is at last made the patient is found to be suffering from a lethal peritonitis. In contra-distinction to the symptoms occurring in the above-mentioned cases, we have another type of penetrating and perforating wound, giving immediate and alarming symptoms. In these cases multiple perforations of the mesentery are present and profuse bleeding occurs at once, bringing about profound symptoms of shock. Such cases demand immediate operative treatment.

In the penetrating and perforating wounds with multiple injuries to liver, spleen, hollow viscera and mesenteric vessels, the diagnosis, of course, is simple.

Complicated wounds resulting from both knife or bullet are wounds in which the peritoneal cavity is penetrated by the entrance of the bullet or knife through the chest, the abdomen being opened through the dia-

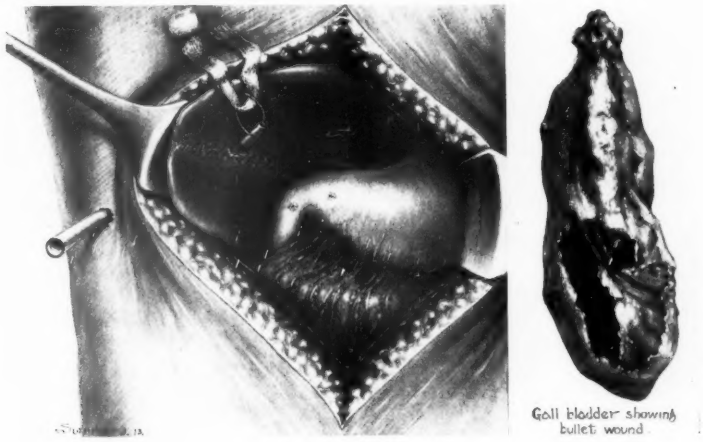

Fig. 2.

phragm. While the majority of wounds of this type are readily recognized, I have seen quite a number of such injuries in which the diagnosis was difficult. In all stab and gunshot wounds, where the bullet or knife enters as low as the sixth interspace, irrespective of symptoms, injury to the diaphragm should be suspected and such wounds should be explored. The exploration should be made preferably through the abdomen. Should exploration be made through the chest and an injury to the diaphragm be found, it would be impossible to tell, without opening the abdomen, whether or not fatal perforations of hollow viscera existed, unless there is present severe shock indicating hæmorrhage. The abdominal route is, therefore, the method of choice, as it will enable the operator to view the damage and apply at once proper methods of repair to both abdominal viscera and diaphragm. This is the only certain method of making a correct diagnosis in cases of this character.

Before taking up the technique to be employed in the handling of these cases, I shall call your attention to several illustrations of the various types of wounds coming under the classification above outlined. Fig. 2 illustrates a type of penetrating and perforating wound. It will be noted that the bullet entered the peritoneal cavity at the lower border of the ribs on the right side, penetrating liver, gall-bladder, and stomach, the wound of exit being at the outer border of the left rectus muscle. This patient was operated on one hour after he was shot and his recovery was uneventful.

Fig. 3 shows a complicated stab wound of the chest and abdomen in which may be seen the spleen, small intestine, omentum, stomach and colon, prolapsed through the diaphragm into the pleura. There were multiple visceral injuries in this case, but the patient recovered following a combined operation.

Treatment. There is but one treatment of such injuries and that can only be accomplished by means of immediate abdominal section and careful repair of all damage to viscera.

The surgical treatment of gunshot and stab wounds of the abdomen may be considered under four heads:

1. Preparation and examination of patient.
2. Method of locating injuries to peritoneal viscera.
3. Repair of such injuries.
4. After-treatment.

Preparation and examination of patient. As many of these cases are received profoundly intoxicated, it is advisable, unless the patient has vomited blood, to wash out the stomach before the anæsthetic is given; the

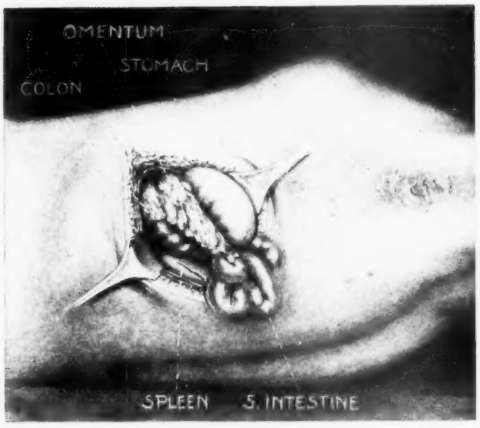

Fig. 3.

removal of the stomach contents will greatly aid both anæsthetist and operator. The abdomen should be prepared in the usual way and the wound of entrance should be carefully explored. No information whatever can be obtained by the use of the probe.

Fig. 4 shows the proper method of incising the wound of entrance and tracing the wound into the peritoneal cavity with the sterile finger. On the left-hand side of this illustration may be seen a classical stab wound of the

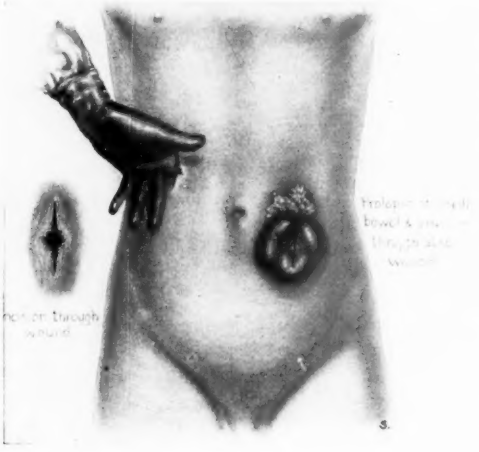

Fig. 4.

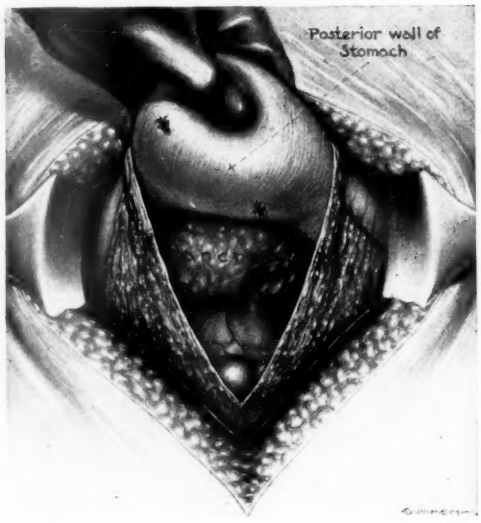

Fig. 5.

abdomen showing the prolapsed small bowel and the omentum protruding from the wound. Before returning prolapsed bowel and omentum, it should be carefully cleansed with normal saline. Occasionally you will find a loop of strangulated bowel in the stab wound. The strangulation is readily relieved by enlarging the wound.

The patient having been prepared, the abdomen is opened through a median incision, beginning an inch below the ensiform cartilage and extending an inch below the umbilicus. This incision gives free access to the abdominal viscera and can be lengthened in either direction if conditions demand.

Method of locating injury. There is nothing of more importance in dealing with injuries of this type than a thorough examination of the entire peritoneal contents. It is a well-known fact that unless a systematic search for visceral injuries is made, perforations will be overlooked and the overlooked perforation is, as a rule, the one responsible for the patient's death. It is, therefore, necessary that such a search be made in a manner that will enable the operator to handle the viscera as gently and rapidly as possible, without adding to the already existing shock. The

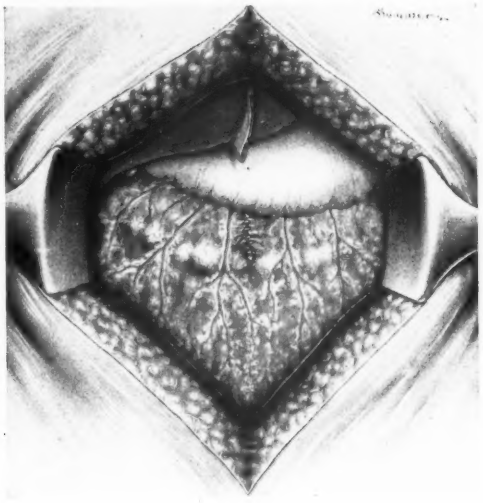

Fig. 6.

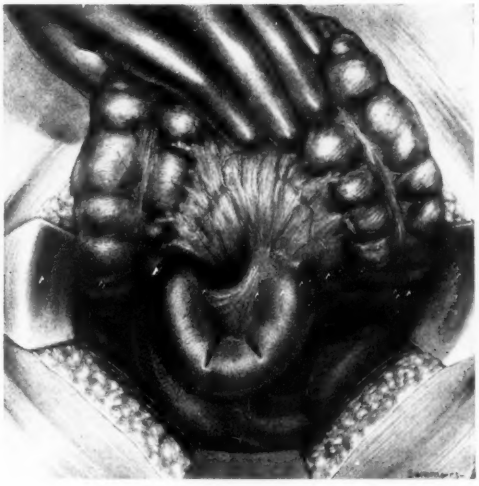

Fig. 7.

method I have found most satisfactory is as follows:

As soon as the abdomen is opened the liver and spleen are examined, and if hæmorrhage from either organ exists it should be properly dealt with. If such hæmorrhage can not be controlled through the median incision, it is advisable to cut the rectus at right angles. This procedure, while by no means ideal, will enable the operator to quickly control the hæmorrhage, and produces less shock than would follow the forcible retraction of the median incision and the rough handling of the injured viscera. The anterior border of the stomach is now searched for perforations. If no perforations are found, a rent is made in the gastrocolic omentum, opening into the lesser peritoneal cavity. Through this opening the posterior wall of the stomach is examined and any injury to the stomach or pancreas is noted.

Fig. 5 shows the technique. The wound in the omentum is at once closed in the manner shown in Fig. 6. The transverse colon is next examined and particular attention is paid to both the splenic and hepatic flexures, as wounds in this locality are frequently overlooked. Throwing back the transverse colon, the small bowel will be seen to emerge through the transverse mesocolon as is shown in Fig. 7. Lifting up the small bowel at the angle of Tritz, the operator examines it inch by inch as the assistant returns it to the peritoneal cavity (Fig. 8). All perforations found are immediately repaired, and when the small bowel is traced to the ileocæcal valve, the operator may feel confident that no perforations have been overlooked. The cæcum, ascending and descending colon, and sigmoid are next examined and if, in the judgment of the operator, it is necessary, the patient is placed in the Trendelenburg posture, so that any wounds that may exist in rectum or bladder may be located and repaired. I have found this method of search simple and satisfactory. If the patient is profoundly shocked, it is generally my custom to start irrigating the abdominal cavity with saline, as soon as the peritoneum is incised. Fig. 9 will illustrate the method by which this is accomplished. You will note the stab wound above the pubis with the drain placed in the vesicorectal pouch and the saline flowing from the tube. This irrigation is not done for cleansing, but for stimulation. It is astonishing how quickly a badly shocked patient will show signs of improvement as the hot saline is absorbed. I called attention to the value of this procedure in a paper read

Fig. 8.

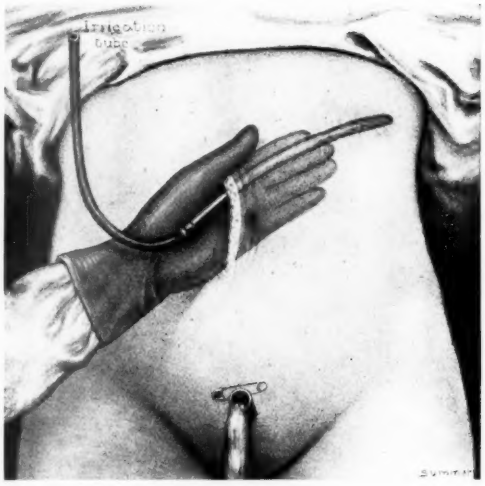

Fig. 9.

before the Mississippi Valley Medical Association on Oct. 12, 1904. Dr. E. Wyllys Andrews, of Chicago, has since devised a special irrigating apparatus for this purpose.

In the repair of perforations of the bowel I have found that they can best be closed either by a purse-string suture or by a through and through stitch, supplemented by the Lembert stitch. Not infrequently multiple perforations are found in close proximity, necessitating bowel resection. Fig. 10 illustrates a rapid method of bowel resection in such cases. The bowel is folded on itself and the mesentery is clamped with a strong forceps, the segment of injured bowel is rapidly removed, and a cobblers' stitch is now placed to control hæmorrhage. The anastomosis can then be made with the Murphy button or suture (Fig. 11).

It is far better to resect in such cases than to repair with suture if there is the slightest question regarding the blood supply to the bowel.

WOUNDS OF THE LIVER

Gunshot wounds of the liver are seen far more frequently than stab wounds. This is explained by the fact that the majority of people are right-handed, hence, with two individuals facing, the knife in the right hand, would naturally strike the left side. Hæmorrhage from liver wounds at times is profuse, but as the blood pressure in the liver is the lowest in the body, such wounds have a tendency to cease bleeding without interference, unless a large vessel is injured. I again wish to call attention to Fig. 2 which illustrates a method used to control hæmorrhage due to a gunshot wound of the liver in which the gall-bladder and stomach were also injured. You will note the catheter introduced through the wound of entrance and through the wound in the liver, after the gall-bladder has been removed. You will also see the strip of gauze threaded through the loop in the catheter, ready to be drawn through the liver, and the wound of entrance. This accomplishes the double purpose of hæmostasis and drainage.

Fig. 12 shows a method of controlling hæmorrhage from the liver by the use of gauze and suture in combination.

Fig. 13 shows a method of controlling wounds of the liver by the suture alone. In this connection let me say that no special needle is necessary for this work. If a large needle is threaded with No. 3 catgut and we sew with the eye of the needle, instead of the point, we get the same results that would be gotten by the use of the many special needles that have been devised for this work.

GUNSHOT AND STAB WOUNDS OF THE SPLEEN

Gunshot and stab wounds of the spleen are quite common, particularly the latter. It is

Fig. 10.

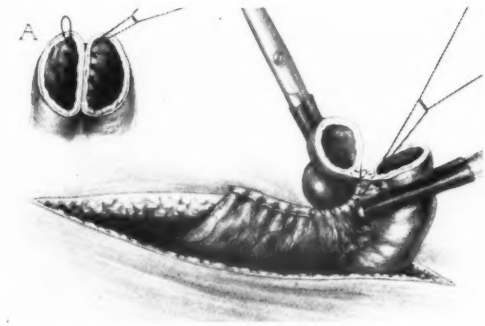

Fig. 11.

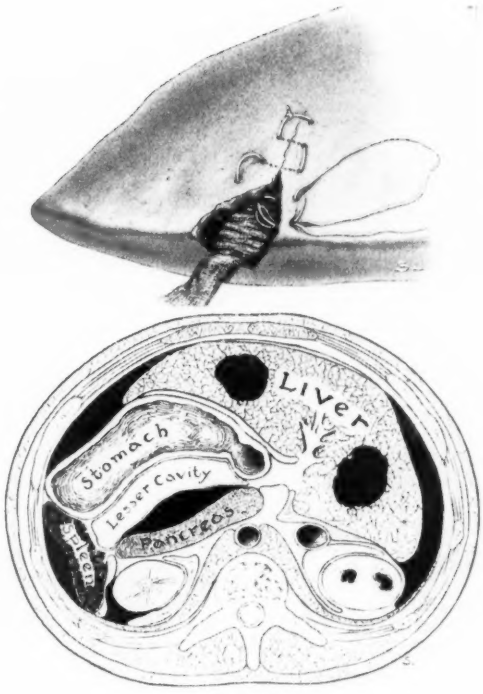

Fig. 12.

important, if possible, to save the spleen. This can often be done by sutures and gauze. Fig. 14 illustrates a method of reënforcing the sutures by utilizing the omentum. To my former associate, Dr. Kirchner, belongs the credit for devising this technique which has been the means of saving the spleen in a number of cases without the use of which splenectomy would have been necessary. If the rent or wound in the spleen is such that it can not be repaired by suture and omental reënforcement, the spleen should be removed. Fig. 15 shows the spleen delivered through the abdominal incision, ready for removal. Fig. 16 shows the interlocking figure of eight sutures in place, to control hæmorrhage from the stump after removal of the spleen.

INJURIES TO THE DIAPHRAGM

The handling of complicated wounds is at times difficult, as the diaphragm is invariably injured. Prolapse of viscera into the chest is the rule, and we have to deal, not only with the pleura and diaphragm, but with the abdominal contents as well. If a loop of bowel is prolapsed into the pleural cavity and the bowel is perforated, the pleura is always infected. A wound of the diaphragm can frequently be repaired through the chest wound, and when the wound in the chest is sufficiently large to permit such repair, it should be done (Fig. 16). As the abdomen must be opened in all such wounds, the combined method is the method of choice. Fig. 17 illustrates the diaphragm being repaired through the abdominal incision. Note the forceps pulling the diaphragm down.

It is astonishing how slightly the patient is affected by a pneumothorax of one side. I have often viewed, through a huge chest wound, the lung partially functionating with the patient lying tranquilly on the table. After the diaphragm has been repaired, in-

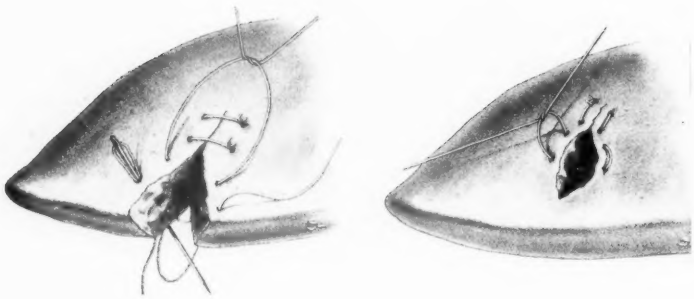

Fig. 13.

juries to abdominal viscera should be searched for and properly handled. If there has been no contamination of the pleural cavity, the chest wound should be closed without drainage. If, however, infection of the pleura is suspected, drainage should be instituted.

It has been my invariable custom to drain all gunshot and stab cases where there was extensive soiling of the peritoneal cavity and where severe hæmorrhage existed. The drainage is accomplished by means of a glass tube introduced through a stab wound above the pubis and placed at the most dependent portion of the vesicorectal pouch, as illustrated by Fig. 19. In the lower left-hand corner is shown the improper method of placing the drain, the cut above showing the proper method.

Closing the abdominal wound. If the patient is badly shocked, the wound should be closed with a through and through suture, as it can be more quickly applied than the layer suture. Although it would seem out of place to illustrate the technique of a through and through closure before so distinguished a body of surgeons, my observation has been that few operators make such a closure correctly. Fig. 20 illustrates the method taught by that great pioneer and master abdominal surgeon, the late Joseph Price. The closure is made with a long, straight needle; the skin is retracted and the needle is made to pierce the margin of the skin and body of the rectus muscle, catching the edge of the peritoneum. The needle next traverses the opposite side in the same manner. When the sutures are all placed, the ends are bunched and the wound is elevated by traction. When the sutures are tied, it will be seen that the peritoneum will approximate, and perfect coaptation of like tissues from below upward is accomplished. A beautiful coaptation of skin is obtained by using the "gliding approximation" taught us by the lamented Price. If the patient is not too badly shocked, the ordinary closure should be made.

MORTALITY

The mortality in gunshot and stab wounds of the abdomen is high—approximately 50 per cent. Dr. Kirchner and I are now at work carefully tabulating the large number of cases coming under our care during our service at the St. Louis City Hospital. We hope to publish shortly a complete analysis of the histories of all our cases. Granting a mortality of 50 per cent following operative treatment of such injuries, I candidly believe that 100 per cent mortality would result from the expectant plan of treatment in all cases where multiple bowel perforations existed.

As the after-treatment of gunshot and stab wounds is practically the same as that applied to the treatment of the conditions which are next to be considered, I will discuss it later.

INJURIES TO ABDOMINAL VISCERA RESULTING FROM SEVERE ABDOMINAL CONTUSIONS

Such injuries are, as a rule, the result of falls, kicks, or blows to the abdominal wall,

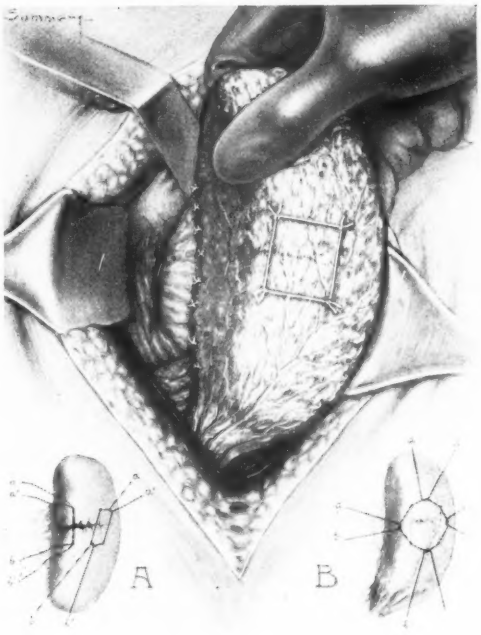

Fig. 14.

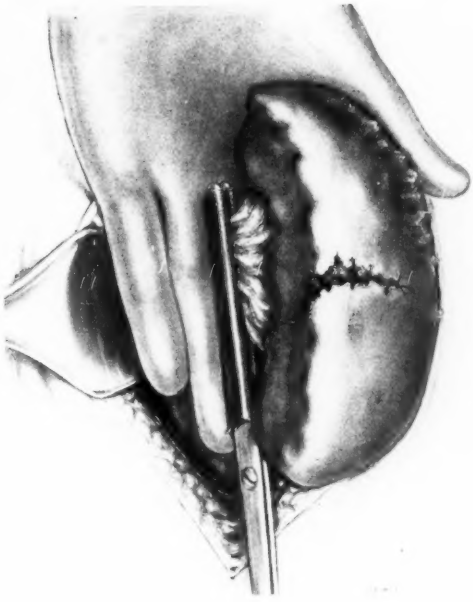

Fig. 15.

automobile accidents, etc. The viscera usually involved are the liver, spleen, small bowel, mesentery, and bladder. In many of these cases, profound symptoms of shock immediately develop. In others, the symptoms are slight. Careful examination of such patients will, as a rule, indicate that injury to viscera has occurred. Early exploration should be the rule in all such injuries. To show that severe damage to viscera can exist without producing alarming symptoms, I shall briefly relate a case:

A young boy, seventeen years old, who came under my care at the St. Louis City Hospital. While returning from swimming, he fell heavily upon a large boulder, striking his left side. Although he suffered temporarily from shock, he was able to walk to his home, a distance of eight blocks, one-half an hour after receiving the injury. Three days after the accident he was admitted to the hospital with a high temperature, rapid pulse, and on examination a large mass was found on the left side in the region of the spleen, extending well over to the midline. The expectant plan of treatment was applied in this case. Twenty-four hours after admission the capsule of the spleen ruptured, and although splenectomy was immediately done, he died a few hours later, as the result of hæmorrhage and shock due to a large rent in the spleen.

Another most interesting case illustrated by Fig. 21 was admitted to the hospital with the following history: This patient, a telegraph operator by occupation, while intoxicated, was struck by an automobile and rendered unconscious. Regaining consciousness, he came to the hospital and was admitted as a "walker." Upon examination it was found that he had sustained a fracture of the upper third of the right arm, abrasions and contusions on the legs and hips. At this time there was no evidence of the existence of internal injuries. When admitted to the hospital at 3:50 A. M., his pulse was 100, respirations 24, temperature 98.8°. On the following afternoon, his pulse was 84, respirations 24, and temperature, 101°. He complained of abdominal pain and was unable to urinate. The abdomen became distended and tympanitic. The recti muscles became rigid and there was dullness in both flanks. He complained of intestinal cramps and vomited fluid containing undigested food. His pulse was 118, respirations 24, and temperature 100° Fahrenheit. A diagnosis of obstruction was made and the abdomen was immediately opened. The mesentery was found bruised in several places, and in one place there was a large rent extending from the root of the mesentery to the border of the intestine. A loop of small bowel was found prolapsed through the mesenteric rent

Fig. 16.

and tightly constricted. The obstruction was reduced and the mesentery was repaired. No further injuries were found. The patient made a rapid recovery.

The two cases reported above illustrate the fact that severe and fatal injuries of this type may exist with practically no symptoms. In contra-distinction to the symptoms found in the two cases above reported, Fig. 22 shows a severe injury to mesentery and jejunum.

This patient, a well nourished male, 29 years old, was admitted to the hospital twenty minutes after having been run over by a wagon. He gave evidence of profuse hæmorrhage and was badly shocked. The abdomen was immediately opened and the injury to the jejunum and mesentery as here shown was found. The mesentery was repaired, resection of the bowel was made, and an end-to-end anastomosis was done with the Murphy button. The patient died, twelve hours after operation, of shock.

RUPTURE OF THE URINARY BLADDER

Rupture of the urinary bladder almost invariably results from abdominal contusions. Such ruptures may be extra or intraperitoneal. Uncomplicated injuries to the bladder of this type are readily recognized and respond quickly to early operation. The complicated types, namely, those in which there exists severe injury to pelvic bones and to abdominal viscera, give a high rate of mortality. Ten

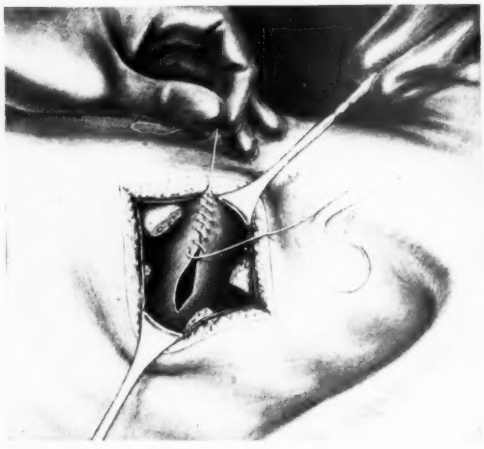

Fig. 17.

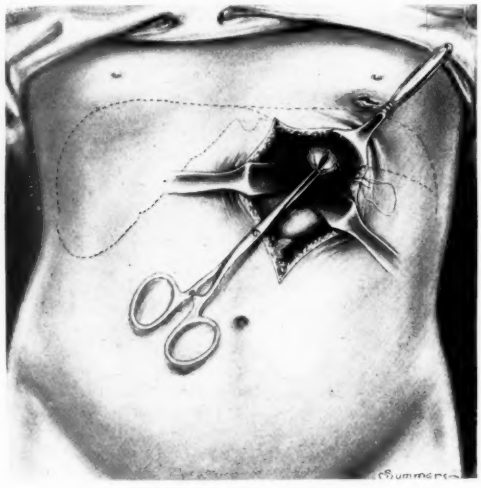

Fig. 18.

cases of rupture of the bladder have come under my observation. Three of these were extraperitoneal. All recovered following operation. Four were intraperitoneal ruptures with two recoveries. I may add here that one of these cases was operated on by me in 1888. Of the complicated cases, namely, those where intraperitoneal rupture of bladder exists, associated with severe crushing of pelvic bones, all died.

Fig. 19.

ACUTE INTESTINAL OBSTRUCTION

At the last meeting of this Association, Dr. Alexius McGlannan of Baltimore presented a splendid clinical study of 181 cases of acute intestinal obstruction. In this paper he clearly demonstrated the importance of the early recognition of this condition and its prompt relief by surgical measures. In a recent paper read before the American Association of Obstetricians and Gynecologists, Dr. Walter C. G. Kirchner reported a careful study of seventy cases of bowel obstruction occurring during his service and the service of the writer at the St. Louis City Hospital. From a study of these cases, he arrived at practically the same conclusions as those of Dr. McGlannan. Both the studies of Kirchner and McGlannan show a high rate of mortality and that a large majority of such cases reach the operating table late. In the seventy cases reported by Kirchner, forty-seven were due to strangulated hernia. Of the forty-seven it was necessary to resect

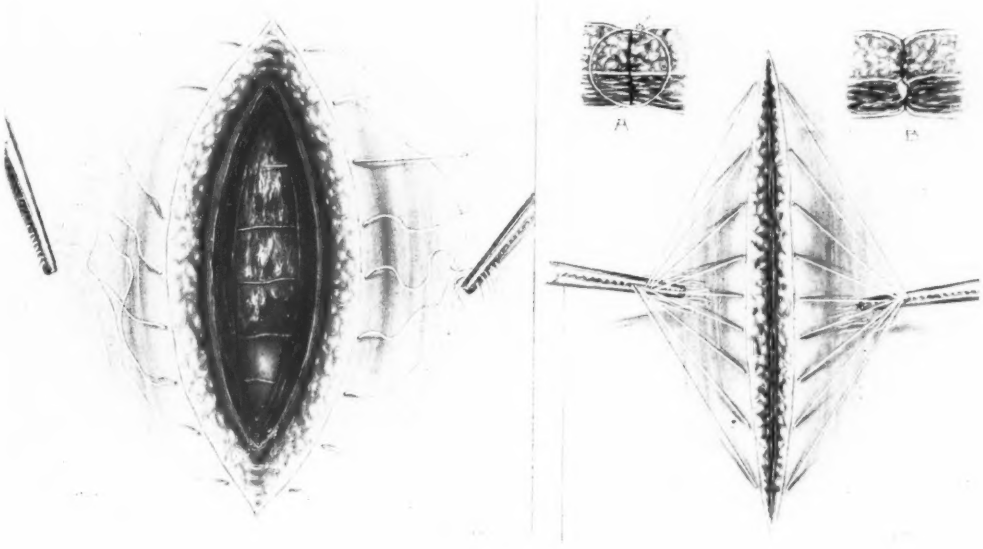

Fig. 20.

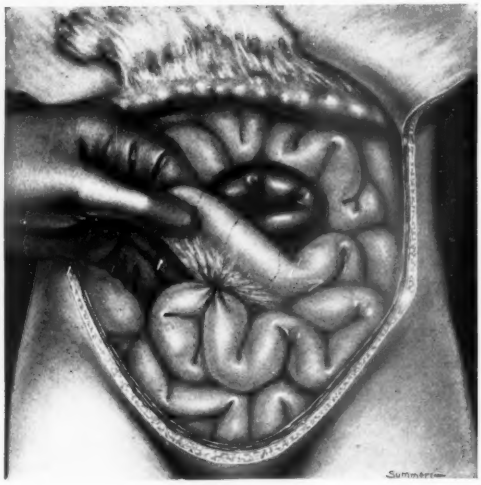

Fig. 21.

Fig. 22.

gangrenous bowel in fifteen, and in two enterostomy was done. The mortality was 28.8 per cent. Of the various obstructions not due to hernia there were twenty-three: one in which resection was necessary, and in three enterostomy was performed. Mortality was 52 per cent. In ten cases of obstruction due to post-operative adhesions bowel resection was necessary in one, and in one enterostomy was done. The mortality was 50 per cent. Four cases of obstructions due to pre-operative adhesions, in one of which enterostomy was done, resulted in a mortality of 50 per cent.

From the frightful mortality resulting from this condition we can reach but one conclusion, namely, that the general practitioner is badly in need of enlightenment on this subject. In our series of cases some rather unusual conditions were found. Fig. 20 illustrates the condition found in a case which I briefly report.

The patient, 55 years old, was admitted to the hospital profoundly shocked and vomiting fæcal matter. The abdomen was greatly distended. His pulse was 96, his temperature was subnormal. He was immediately taken to the operating room, and on opening the abdomen a huge gall-stone was found blocking the ileum, eighteen inches above the lieocæcal valve. One of the interesting features of this case was that the patient had a Meckel's diverticulum. This, however, had nothing to do with the obstruction. The gall-stone and diverticulum were both removed. The patient made an uninterrupted recovery.

Fig. 24 illustrates a most interesting case, that of a young man who came to the hospital with the history of eight days' illness. The boy was the son of a doctor, and his father stated that from early infancy he had suffered at frequent intervals from intestinal colic and vomiting, usually relieved by castor oil. On admission to the hospital, his condition was critical. On opening the abdomen, his appendix was found attached to a Meckel's diverticulum, and through the opening made by this attachment the small bowel had prolapsed, twisting the pedicle of the Meckel's and bringing about an acute obstruction. The diverticulum was gangrenous. The appendix and diverticulum were quickly removed, thus relieving the strangulation, and the boy made a nice recovery. Fig. 25 shows the gangrenous diverticulum and appendix.

Treatment. No hard and fast rules can be laid down relative to the treatment of acute obstruction. Too much stress can not be laid on the importance of preparing such cases for operation. As the majority of them come in profoundly toxic and vomiting fæcal matter, stomach lavage should invariably be

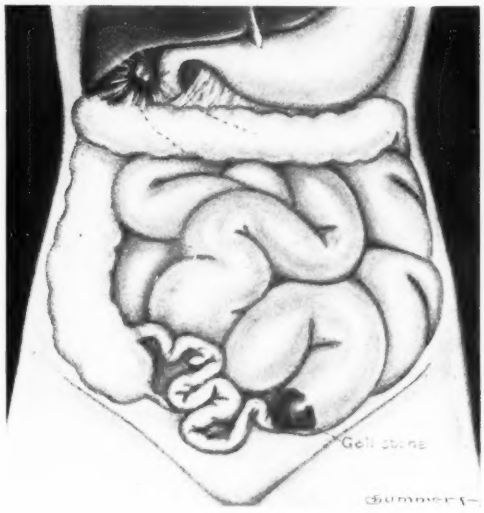

Fig. 23.

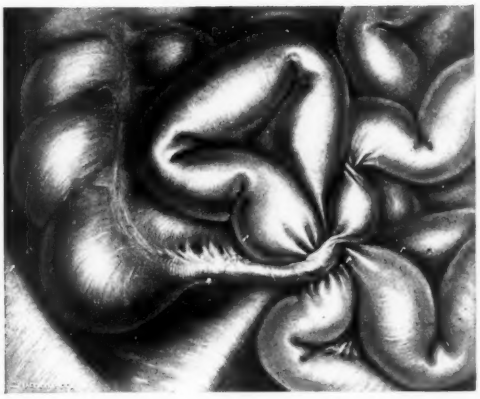

Fig. 24. Showing appendix attached to Meckel's diverticulum, small bowel imprisoned under loop, twisting pedicle of diverticulum, which was found to be gangrenous at operation.

done before the anæsthetic is given. The surgical technique should be carried out as rapidly as possible, consistent with thorough work. I can not too strongly emphasize the importance of draining the bowel of its highly toxic contents in every case.

Fig. 26 shows a rapid method of accomplishing this drainage in cases requiring resection. You will note the tube in the proximal bowel. While the assistant is draining the distended gut above the constriction, the operator is tying off the mesentery. It will be seen that by this method no time is lost and when the resection has been accomplished and the distal end made ready for anastomosis, the distended loop above has been drained of a large quantity of material which, if left, would greatly interfere with the patient's

Fig. 25.

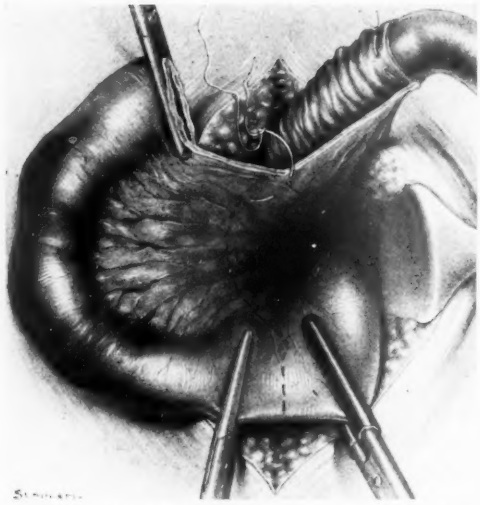

Fig. 26. Method of draining distended loop above block.

recovery. I reported this method in a paper read before the Mississippi Valley Medical Association, in 1904.

In handling gangrenous bowel found in the sac of a strangulated hernia, I have found the method which I will now describe of great value in making an artificial anus. Fig. 27 shows the sac opened and the loop of gangrenous bowel delivered. The constriction having been relieved, a wide resection well back into healthy bowel is done in the following manner: A heavy clamp is made to perforate the mesentery on either side at its intestinal margin and is then closed tightly, thus controlling the hæmorrhage. Two clamps are then placed in order to prevent the healthy bowel from receding into the peritoneal cavity and two other clamps are placed to prevent leakage from the bowel to be removed. When these clamps are placed, the gangrenous gut is quickly cut away. Fig. 28 shows the two ends of bowel fixed in the hernial opening, the clamp on the mesentery filling the double purpose of controlling the mesenteric hæmorrhage and holding the two ends of bowel in position. In the left-hand corner of Fig. 28 will be seen a rubber tube into which one-half of a Murphy button has been inserted. A tube of this type is

Fig. 27.

then introduced into the lumen of both bowels and retained there by means of a purse-string suture.

Occasionally we find a knuckle of small bowel tightly constricted and gangrenous in the sac of a femoral hernia. In all such cases, where it would be unsafe to return the bowel to the peritoneal cavity, and resection has to be done, it has been my practice to make a supplementary abdominal incision, relieving the constriction, pulling the bowel through the abdominal wound, and resecting in the manner described above (Fig. 29). This method makes resection very much safer than by operating at the hernial site. When resection is done at the hernial ring there is always danger of interfering with the approximation, whether made with the button or suture, returning the bowel to the peritoneal cavity.

After-treatment. The after-treatment of all

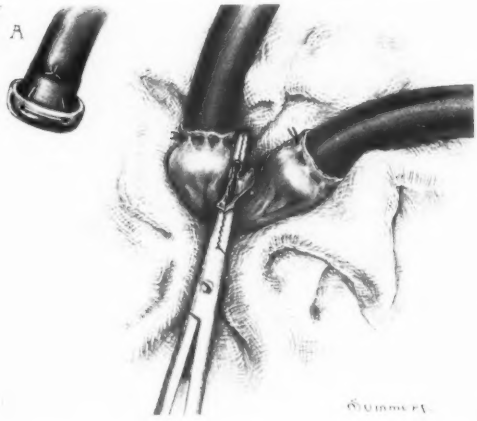

Fig. 28.

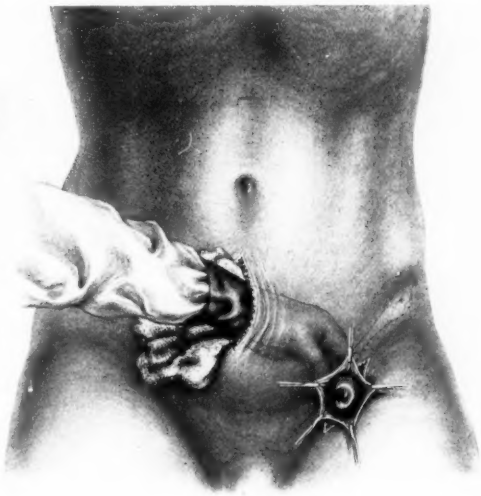

Fig. 29.

of the types of cases above considered should be as simple as possible. It is our custom unless there are special contra-indications to allow such patients to have all the water they desire. Strychnine is never used, and morphine is rarely needed.

Proctoclysis, tap water being used by the Murphy method, I have found of value. The Fowler position I have practically abandoned as a method of treatment, not only in the types of injuries above discussed, but in my other acute work.

In conclusion I wish to thank the fellows of the Association for their patience in listening to the lengthy presentation of this subject.

CALCULOUS ANURIA, WITH REPORT OF TWO CASES[1]

By LINCOLN DAVIS, M. D., Boston
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SUDDEN and total suppression of the urinary secretion as the result of obstruction by calculus is a serious and dramatic surgical emergency which requires prompt and intelligent treatment. It is by no means such a great rarity; the literature abounds in scattered case reports, and probably a majority of the experienced surgeons of this country have each had several cases. The American text-books, however, for the most part dismiss the subject with a scanty paragraph. It is a condition which any one of us is liable to run into at any time without warning and which we should be prepared to meet intelligently. The collated experience of others has brought out certain facts in regard to the condition which are interesting and important.

Anuria is a symptom which has been described by medical writers from the earliest times; its pathology, however, long remained in densest obscurity and is still far from being fully understood. Alpin in the sixteenth century was the first to call attention to anuria of strictly obstructive type.

The treatment in the early days was entirely expectant and a number of cases of calculous anuria are reported, in which spontaneous expulsion of the stone was followed by what the French call a urinary débacle and cure. Such happy results, however, were the exceptions to the melancholy general rule, and with the advancement in the art of surgery it was but natural that operative measures should be resorted to for relief in this dangerous and usually fatal condition. Guermonprez (1), a French surgeon, is credited with being the first to operate for calculous anuria, in 1870. He performed left lumbar nephrotomy, finding the kidney and pelvis greatly dilated and the ureter blocked by a stone, the right kidney being absent. Death resulted on the third day. Bardenheuer is credited with the first successful case, in 1882. Henry Morris, that brilliant pioneer of renal surgery, was an early operator for this condition. In his text-book of diseases of the kidney and ureter, he discusses the subject of calculous anuria in considerable detail. He collected, in 1898, 97 cases from the literature; in 48 of these no operation was performed, 10 recovering and 38 dying, a mortality of nearly 80 per cent. In 49 cases in which operation was performed the mortality fell to 51 per cent. Many operative cases have been published since Morris' compilation, with a steadily diminishing mortality. The mortality statistics depend largely upon the stage of the disease reached when surgical intervention was undertaken. Early writers counselled waiting until the fifth or sixth day of anuria before interfering surgically, with the hope of spontaneous relief. It was observed that a patient would often remain in comparative well being and comfort for five to six days, with total anuria, before the advent of uræmic symptoms. This relatively symptomless period was called the period of tolerance. Succeeding writers kept cutting down the period of waiting until the sound advice was pretty generally promulgated that it was better to operate at once. In recent times, with the advent of the cystoscope and ureteral catheter, a number of successful cases have been recorded which were treated by the ureteral catheter alone. These somewhat fortuitous results have encouraged certain authorities to advocate the use of the ureteral catheter as a means of treatment, at least as a preliminary measure. That the ureteral catheter has an important place in the diagnosis and treatment of this condition cannot be gainsaid, but that it will often be of permanent curative value is, I think, doubtful.

What is calculous anuria? Calculous anuria is the complete suppression of urinary secretion by obstruction of the renal outlet by one or more calculi. It occurs under the following conditions:

1. When a ureteral or pelvic calculus ob-

[1] Read before the Buffalo Academy of Medicine, December 2, 1913.

structs a congenitally single kidney, or one whose fellow has been removed by operation, or destroyed by disease.

2. When both kidneys are blocked by ureteral or pelvic calculi.

Many authorities maintain that anuria may, and does, occur under a third condition: so-called reflex calculous anuria, *i. e.*, that if one kidney is blocked by a calculus, a reflex inhibition may cause cessation of function of the opposite kidney, although the latter remain unobstructed. This is somewhat of an academic question which has been much argued pro and con; it is not, however, without practical importance, and I shall refer to it in some detail later.

The clinical aspects of calculous anuria with some of its diagnostic and operative pitfalls are well exemplified by two personal cases in which the final results were favorable. The clinical histories of these cases were as follows:

CASE 1. C. D. C., No. 178352 E. S. Mass. Genl. Hosp., 43 years, widow, brought to accident room at 3:15 P. M., September 17, 1911.

Previous history. Unimportant, except that she has had three previous attacks of anuria of less than one day's duration during last month. No pain or other urinary symptoms. Two days ago seized with sudden severe, knife-like pain in left loin, which radiated into groin; came on when she was going to bed. She vomited and felt chilly. Pain was not relieved by morphia. One-half hour after onset of pain felt as if something gave way in left loin, with slight relief. She had passed no urine since the night of September 15th. Pain has persisted but is less severe. Catheterized twice by local doctor, who obtained no urine. Bowels moved to-day, vomited yesterday.

Examination. Well developed and nourished woman. Pupils very small and react very slightly. Tongue coated, teeth false, throat negative. No adenopathy. Heart, soft systolic murmur at base. Lungs negative. Abdomen soft and distended. Liver edge two inches below costal margin in nipple line. In left loin there is a moderate amount of spasm and tenderness. No costovertebral tenderness. Knee-jerks present and lively. No œdema.

Vaginal examination. Negative, except for small polyp of cervix. Temperature 99°, pulse 70, respiration 22, white count 16,000. Patient catheterized, ʒii of urine obtained, sediment of which showed numerous leucocytes and small round cells, rare blood-corpuscles and granular casts. Patient was put to bed, given urotropin, fluids forced, and hot poultices applied to left loin. Catheterized next morning and no urine obtained. Patient states that her face feels swollen, no other signs or symptoms of toxæmia. X-ray taken, negative for stone in kidneys, ureters, or bladder. It was decided to operate without further delay. This was on Monday morning, ʒii of urine only having been obtained since the previous Friday evening, sixty hours. Left kidney exposed through a loin incision, found much enlarged, congested and purple in color. A nephrotomy was done, and when the pelvis was reached there was a gush of bloody urine estimated at several ounces. The pelvis and ureter were then explored digitally but no stone felt. There was considerable venous oozing from the cut surface of the kidney as well as from its capsule. Two small gauzes were packed into the nephrotomy wound and two large gauzes were packed about the kidney. Patient made a good recovery from ether. There was considerable staining of the dressing with a distinct urinous odor. In the afternoon of the day of operation the patient began to void urine naturally; on the third day after operation she voided 80 oz. On the fifth and sixth days she voided nothing. though there was constant desire to do so. Patient had considerable pain and appeared quite sick. There was slight œdema of the face. There was profuse urinary leakage from the wound. On the sixth day patient passed about 20 small stones, the largest of which was the size of a green pea. After that, urination became free and the amount draining from the wound very slight. On the thirteenth day the drainage from the wound, which had ceased, began again and the patient was unable to void. She finally passed a small stone on this day and another three days later. Normal urination had again established itself. Cystoscopy at this time showed a somewhat inflamed bladder with a dilated, ragged-looking left ureteral orifice. No sign of a right ureteral orifice could be found. There was no excretion of indigo-carmin during an observation of twenty minutes. Colorless urine, containing particles, was seen to issue from the left orifice at regular intervals. On the thirty-first day two more small stones were passed; stones were passed daily for the next five days. Patient was discharged to Waverley on the forty-ninth day; the wound healed solidly; there was no pain and the general health very good. The urine at this time was normal. I have seen the patient several times since and her health continues excellent; she has passed no more stones. A cystoscopic examination, made on February 13, 1913, showed a tiny slit in the position that corresponds to that of the right ureteral orifice; it remained absolutely inactive and it was impossible to engage a No. 6 ureteral catheter in it. The left orifice appeared active and normal.

CASE 2. J. F. F., No. 186395 E. S. Mass. Genl. Hosp., 27 years, single, machinist. This patient was admitted through the accident room at 1:15 P. M., December 5, 1912, from the Lakeville Sanatorium, with the diagnosis of anuria. Family history, several uncles and aunts died of tuberculosis. Previous history, diphtheria in childhood; tuber-

culosis of lungs since a year ago last October; has had five hæmorrhages; has no cough at present. Patient says he inhaled a loosened tooth into his lungs and coughed the tooth up eighteen months later. After raising the tooth there was no further cough or hæmoptysis. Habits good. Present illness. When a boy, was treated at Boston Emergency Hospital for blood in urine. No trouble from that time until nine months ago when he had pain for two days in the left kidney region. Urine stopped once or twice during this time, and finally, on the second day of the attack, he passed a stone. Pain has always been on the left side. Last August he had another attack, with vomiting. Passed no urine for a day, but finally passed a stone with entire relief.

Sunday night, December 1st, five days ago, began to have sharp pain in the left side, running down into penis. Has not passed a drop of urine since Monday morning, four days ago; appetite failed; frequent vomiting.

Examination. Well developed and nourished man, rather obese. Nervous and talkative. Mind clear. Breath smells of acetone. Eyes a little puffy. Skin pasty and moist. Mucous membranes pale. Pupils equal, regular, react normally. Teeth poor, some pyorrhœa. Tongue heavily coated, dirty white. Throat not remarkable. Dullness at right apex, lungs otherwise negative. Heart not enlarged, sounds rapid, regular. Soft systolic murmur heard best over pulmonic area. Abdomen full, tympanitic throughout. Tenderness in left costovertebral angle and slight tenderness along course of the ureter. Kidney not palpable. Both epididymes thickened. Knee-jerks normal. Rectal examination negative. Temperature normal. Pulse 90. Respiration 20. Immediate X-rays were taken, which showed a definite shadow low down in region of right ureter, other shadows in region of right kidney, questionable shadow in pelvis of left kidney.

Cystoscopy. Cystocope passed, bladder empty. Filled with boracic solution. Bladder not remarkable. Both ureteral orifices seen, the right one appearing swollen, reddened, and distorted. Unable to catheterize right ureter, thought to be partly due to abnormality of orifice and partly to faulty catheter. Left ureteral orifice readily catheterized and catheter passed to kidney pelvis with a scanty flow of clear urine, about ten drops. Catheter fastened in place and patient sent back to ward. The diagnosis at this time was calculous anuria, stone in right ureter, reflex anuria of left kidney. The ureteral catheter drained nothing during the night; the patient pulled it out before morning, but with a hypodermic of morphia passed a fairly comfortable night. There was no secretion of urine, however. More X-rays were taken in the morning, but without waiting for their development I decided on immediate operation. This was the beginnnig of the sixth day of complete anuria. The right kidney was exposed by an oblique incision in the loin. The kidney was found very small and lobulated, evidently destroyed by an old tuberculous process, ureter opened and found packed with caseous material. The pedicle of the kidney tied off and kidney removed. Ureter freed as far down as incision allowed, and removed, about 3½ inches, a cigarette drain placed to the stump of the ureter. The incision was then closed, the patient turned on the other side and the left kidney cut down by an oblique loin incision. The kidney was found much enlarged, congested, and purple. The edge of a retractor accidentally cut into the renal substance; this incision was enlarged and carried down into the pelvis. No stone could be felt by the finger. This wound was packed with gauze and the pelvis of the kidney and ureter freed from the outside; a small stone was distinctly felt at the pelvic outlet. The pelvis was opened but the stone had slipped out of touch. On account of the serious condition of the patient, a protracted search was not made. A bougie was passed from the pelvis to the bladder, without obstruction. A catheter was fastened into the pelvis of the kidney. The nephrotomy wound was packed with gauze; the wound of the parietes was partly closed in layers with catgut. Before the swathe was pinned, urine commenced flowing from the catheter freely. During the latter part of the operation the condition of the patient caused great anxiety. His color was bad and he stopped breathing several times, requiring artificial respiration. Patient returned to ward in poor condition. Responded to stimulation feebly. There was a very free flow of urine from the catheter in the renal pelvis and also into the dressing.

The specimen of the removed kidney consisted of a mere sac, filled with pultaceous material; the same material also filled the ureter.

The pulse, on the day after operation, rose to 160, and the man appeared desperately sick. The heart rate was counted at 194 by Dr. D. L. Edsall, who saw the case in consultation, and found acute dilatation of the heart, 6 cm. to the right, 12½ cm. to the left of midsternal line. There was some improvement after intravenous injection of strophanthin. There was a marked macular eruption over the entire body. During the next few days there was rapid improvement with very profuse secretion of urine. There was marked desquamation of the skin as the rash faded. In three weeks the wound had nearly closed and all urine was passed by urethra. Nothing had been seen of the stone. A series of very puzzling X-rays, although not conclusive, seemed to show a pretty constant shadow in the pelvis of left kidney. This evidence, in conjunction with the sudden reopening of the wound and discharge of urine on the fortieth day, decided me to reoperate and search for the stone, which I believed still lay somewhere in the pelvis of the kidney.

On January 15, 1913, an incision was made through the old scar. The kidney was freed with some difficulty. Palpation of the ureter and pelvis negative; a rubber-covered clamp was applied to the pedicle of the kidney and a nephrotomy done.

The pelvis was then most thoroughly searched for stone without result; a bougie was passed to the bladder without obstruction. A partly broken down lymph-gland lying near the ureter, which was at first thought to be a stone, removed. The peritoneal cavity was accidentally opened but immediately closed by suture. The nephrotomy wound was packed with gauze, the clamp removed, and the wound closed with drainage. The operation was started under spinal anæsthesia; this was satisfactory at first, but the traction necessary to free the kidney caused pain and ether was substituted for it and maintained to the end. There was again considerable shock after operation. The patient made a slow but steady convalescence and was discharged on February 19, 1913, to the Lakeville Sanatorium, in excellent condition, with a very small granulating wound in the left side, wound in right loin healed.

The final X-ray plates still showed a questionable shadow in the region of left kidney.

The patient has continued to improve since discharge and is now in excellent health. The urine is normal and the wounds are healed.

He was shown at the recent meeting of the American Urological Association in Boston.

These two cases are excellent examples of calculous anuria, and although the operations were in neither case all that might be desired, in that the stones were not found and removed at operation, yet the outcome in both was very satisfactory, and shows the paramount importance and value of drainage as a life-saving measure.

In the first of these cases we have, to the best of my knowledge and belief, a congenital solitary kidney blocked by a mass of small stones in the ureter, with resulting anuria. In the other case we have the active kidney blocked by a stone in the pelvis, with complete destruction of its fellow by an old tuberculous process.

In this latter case I read the signs and symptoms all wrong. The X-ray shadows in the region of the right ureter, the impossibility of catheterizing the right ureter, together with the ease of catheterizing the left, and the obtaining of a little normal urine from it, led me into the false belief that we had to do with a case of calculous obstruction of the right ureter and reflex anuria of the left kidney. The history of pain in the left side, with the muscular spasm and tenderness, should have indicated plainly enough that the obstruction was here. Both cases illustrate the fact that renal drainage is not only a life-saving procedure in these cases, but also by allaying ureteral spasm often permits of spontaneous passage of ureteral stones.

Since my experience with these two cases I have become much interested in the subject of calculous anuria, and particularly in the matter of reflex anuria.

A number of authorities support the theory of reflex inhibition of one kidney, when its fellow is suddenly obstructed, as by calculus, so-called reflex anuria. They admit, however, that such cases are rare.

Watson (2), in his paper before the International Urological Congress in Paris, in 1908, cited 17 cases of reflex calculous anuria out of 187 cases collected from the literature and analyzed by him. Watson estimated that in 20 per cent of the cases of calculous anuria there was obstruction of both ureters by calculus. He made a strong plea for simultaneous bilateral operation in appropriate cases. There was a very exhaustive consideration of anuria at this meeting by eminent world authorities. Many additional cases were reported; some as evidence of reflex inhibition, the majority of reports, perhaps, favoring the view that such a condition, though rare, yet really did exist.

Let us consider the evidence upon which the assumption of reflex inhibition rests. In the great majority of cases cited as examples of reflex calculous anuria, the unobstructed kidney is the seat of more or less advanced disease. These cases, it seems to me, should be thrown out, as the term reflex cannot strictly be applied to the failure of such a kidney. Let us state a hypothetical case. A patient has suffered from attacks of renal lithiasis with infection for a number of years and has passed a number of calculi. We know that in such cases the disease is usually unilateral at first with a very strong tendency to become eventually bilateral. We will assume that at the time the patient comes under observation the left kidney has been considerably damaged by repeated attacks of lithiasis, accompanied with infection, resulting in a condition of pyelonephritis, although at the moment it is entirely clear of stones. The right kidney, on the other hand,

has but recently become the habitat of a calculus, and but little damage has as yet been done to its parenchyma; it is the active organ of the pair, doing three-quarters of the work of elimination for the body. The single small calculus in the right kidney suddenly drops into the renal pelvis and becomes engaged there, blocking its outlet and completely obstructing the outflow of urine. Secretion of the right kidney ceases and all the work of urinary elimination of the body falls upon the damaged left kidney. This feeble and diseased organ is unable to respond to the burden suddenly thrown upon it; it is overwhelmed with work and fails to functionate, with resulting anuria. Why invoke in such a case the complicated phenomenon of reflex action? Is it not purely a case of functional exhaustion? When the stomach is overloaded with indigestible food the secretory glands rebel at the impossible task, digestion ceases, and the overload is thrown off by vomiting. An overloaded kidney cannot relieve itself by vomiting, and if its function is already handicapped by disease it is soon forced to a point beyond which it cannot go, function ceases, with resulting suppression. The suppression of function of a single diseased kidney, or of two such for that matter, as the result of an overwhelming burden being cast upon it, or them, will of course be readily granted by the advocates of reflex inhibition. But they will object that renal failure of such a nature is accompanied or preceded by all the well-known symptoms and signs of uræmia, while in these cases of calculous anuria there is a striking lack of any such signs for from three to six days after the anuria has become complete, the so-called period of tolerance. This is undoubtedly true in the vast majority of cases which is generally conceded to consist of those in which the entire functionating renal substance has been suddenly put out of commission by calculous obstruction of the only active kidney, or of both kidneys. It is a striking fact, however, that in the few cases of anuria recorded in which the second kidney was found unobstructed but diseased uræmic symptoms supervened early. Cases of Marcille and Leonté (3).

If a structure is supported on two pillars, and one of these, the stronger of the two, is suddenly knocked away, so that the whole weight is thrown on the remaining weaker one, whose strength is unequal to the burden, its collapse is not spoken of as a reflex act.

Fortunately for the human economy, either kidney alone is amply capable of carrying on the normal work of elimination for the body, if sound or nearly sound. At just what degree of unsoundness of a single kidney renal failure ensues it is impossible to determine, many complex factors entering into the problem.

It seems to me that the term reflex should be applied only to such cases as those in which the supposedly inhibited organ is organically sound. If one accepts this proposition, the problem is simplified and the number of cases becomes considerably diminished. Watson's seventeen cases, for example, are immediately reduced to seven, and careful scrutiny of these raises the question whether other interpretations than reflex action are not applicable.

Donnadieu (4) in 1895 analyzed forty-six cases of calculous anuria, with the following results: In six cases there was absence of the second kidney; in thirteen cases the obstruction was double; in twenty-three cases the function of the second kidney was suppressed as the result of traumatism in one, cystic degeneration in one, lithiasis in twenty-one, leaving four cases in which he considered the suppression of the second kidney as due to reflex action. In these four cases he admits there may have been some lesion present in the inhibited organ.

Huck collected, in 1904, sixty-one cases from the literature which had appeared since Donnadieu's work. Of these, thirty offered sufficiently explicit data for analysis. He found thirteen cases of bilateral obstruction of the ureters; four cases of obstruction of one ureter, the other kidney being completely atrophied; three cases of obstruction of one ureter, the other kidney being congenitally absent; five cases of obstruction of one ureter, the other kidney having been nephrectomized; three cases of obstruction of one ureter, the other kidney presenting no

obstruction, verified at autopsy. These are cases of Marcille, Leonté, and Albaran. In two of these latter cases there was diffuse nephritis of the unobstructed kidney. This leaves but one case out of thirty in which there is question of reflex inhibition of a sound kidney. And in this case exact histological data as to the condition of the unobstructed kidney are lacking; it is merely stated that it was enlarged and congested.

In fact, as far as I have been able to learn, no cases have been reported of so-called reflex calculous anuria backed by convincing post-mortem and histological evidence of the soundness of the unobstructed kidney. This is an essential desideratum for acceptance of the theory.

As Legueu (5) points out, kidneys which appear macroscopically normal may be totally degenerated and even a slight proliferation may suffice to definitely compromise their function.

Let us consider next the purely clinical evidence, some of which seems at first glance to be quite strong. These cases divide themselves into two groups—those in which evidence of the return of function of the unobstructed but inhibited organ is gained by the use of the ureteral catheter and the flow of normal urine and those in which, after a nephrotomy with drainage of bloody urine from the wound, the passage of large amounts of clear urine from the bladder is looked upon as of like import.

These cases are, of course, very suggestive, especially when backed by corresponding X-ray evidence, as a few of them have been, yet they are susceptible of other interpretations. In the first place the obtaining of normal urine is not conclusive evidence that the kidney from which it comes is normal. The kidney may be congenitally small, of infantile type, or atrophied and incapable of carrying on alone the work of elimination for the body, and yet secrete a small amount of normal urine. Again, many cases of considerable degrees of interstitial nephritis are undetectable from urinary analysis. Furthermore, the ureteral catheter may dislodge a stone and obtain practically normal urine, as undoubtedly happened in my second case. A frequent source of error is ureteral spasm provoked by a small calculus. The ureteral spasm yields to narcosis and allows urine to pass although the stone still remains in the ureter. Three instructive cases of this kind are cited by Huck, two reported by Bruch, and one by Weiss, in which urine was voided naturally after unilateral nephrotomy for calculous anuria, and yet double ureteral obstruction by calculus was proved later at autopsy. A calculus acting as a ball valve might also be mistaken for reflex inhibition. Ureteral spasm practically always accompanies the passage of a stone down the ureter and is the cause of the accompanying renal colic. It is associated with anuria of the corresponding kidney probably in most cases. I had occasion recently to observe it in a case of right ureteral fistula, in which a stone became engaged in the opposite ureter with entire cessation of entrance of urine into the bladder for thirty-six hours. The vagaries of renal colic are well known. A stone may be impacted in the ureter tightly, without colic and without anuria; ureteral spasm may relax at any moment and allow the passage of the stone, or allow the passage of urine, the stone remaining in the ureter.

A case is recorded of a patient with anuria falling out of bed while writhing in the agony of renal colic, followed by immediate cessation of pain and resumption of normal urinary secretion.

Under these circumstances the cases of Israel (6), Kreps (7), Imbert (8), Rovsing (9), and others in which the reëstablishment of urinary secretion in the supposedly unobstructed but inhibited kidney was shown by ureteral catheterization, although very suggestive, cannot be considered as wholly convincing. The same applies to the case of Pousson (10) and others of like nature.

Legueu maintains that inhibition does not enter into the problem of calculous anuria at all; that it is not inhibition that arrests secretion of the obstructed kidney, but increased tension, for once the kidney is opened, although the calculus remains untouched, secretion is resumed. It is the letting up of renal tension which allows the kidney to resume function.

Experimental evidence of the renorenal reflex inhibition due to obstruction of a ureter is scanty. Götzl (11), whose work has been extensively quoted by advocates of the reflex theory, was able to produce temporary anuria in three out of twelve experiments on dogs by obstruction of a single ureter. His results, however, are vitiated to a certain extent by the fact that the dogs used were narcotized by large doses of morphine, so that there was a toxic element present. I cannot find that his experiments have been substantiated by others. Dr. J. D. Barney of Boston has done considerable experimental work on the ligature of the ureter in animals. He reports thirty-three cases of unilateral ligation of the ureter—seven in rabbits and twenty-six in dogs—without the occurrence of anuria in a single case. He noted a temporary diminution of the urine secreted from the unobstructed side for a day or two, followed by a compensatory hypersecretion later. He found varying degrees of hydronephrosis in the obstructed kidney in all cases, indicating a rise of intrarenal pressure. Barney also collected sixty-two authentic cases of sudden and complete occlusion of the ureter by ligature or clamp in the course of operations on human beings. Of these sixty-two cases the ureteral injury was unilateral in forty-six and bilateral in sixteen, the large majority occurring in the course of a hysterectomy, vaginal or abdominal. Anuria occurred in all the bilateral cases, as was to be expected. In the forty-six unilateral cases anuria occurred but once, the patient dying after thirty-six hours of acute uræmia. Data as to the condition of the other kidney in this case are entirely lacking.

In summing up, then, the subject of reflex calculous anuria, it can fairly be stated that while the possibility of reflex inhibition of a sound unobstructed kidney cannot be absolutely denied, convincing post-mortem, clinical, and experimental proof is still lacking.

It seems unreasonable to ascribe to the mysterious and little understood phenomenon of reflex inhibition the failure of an unsound but unobstructed kidney to secrete, when its more active fellow is suddenly obstructed by calculus, when the simpler phenomenon of functional failure under overload is adequate explanation.

For all practical purposes, then, calculous anuria should be considered a purely mechanical problem and treated as such. The diagnosis having been made, it should be assumed that either only one actively functionating organ exists, which is blocked, or that there is blocking of both kidneys. The indication is to unblock at the earliest possible moment. The diagnosis is usually self-evident and needs but little consideration. The X-ray and cystoscope are of the greatest aid in locating the sites of obstruction and indicating the point of attack. The cystoscope and ureteral catheter have of late years been likewise of therapeutic value in many cases. When the condition of the patient is not alarming, it is undoubtedly wise as a preliminary measure to attempt the dislodging of a ureteral stone, or at least the allaying of ureteral spasm by this means, and it will occasionally suffice in itself to obtain a cure. In desperate cases at once, and in all other cases when the ureteral catheter fails to give permanent relief, operative measures must be resorted to.

The ideal procedure is not only to relieve the tension of the obstructed kidney, but to remove the obstruction as well, and this can often be done when the stone is readily accessible at the outlet of the kidney pelvis. When the stone is impacted in the lower end of the ureter, it will seldom be wise to undertake its removal during anuria. It is safer to be content with simple drainage of the kidney, which will often result by relief of intrarenal pressure, and the allaying of ureteral spasm, in spontaneous passage of the stone. If not, it can be removed later.

Nephrotomy is generally advocated as the method of choice because it is quickly and easily done, secures good drainage, and permits of removal of any stone found in the pelvis of the kidney. It has but one disadvantage, which to me is a very serious one, the danger of hæmorrhage. Pyelotomy is certainly safer, gives equally good drainage, and ample access to any occluding stone of moderate size. Where the kidney is very much enlarged it might be found to be some-

what more difficult. I should personally attempt it in another case. If upon cutting down upon one kidney it is found to be functionally useless, or even considerably damaged, the other kidney should be immediately explored in the hope of releasing whatever functionating renal substance may be imprisoned there. The simultaneous bilateral operation has been ardently advocated by Watson and deserves recognition in appropriate cases. If bilateral obstruction is found to occur in twenty per cent of all cases, this fact would seem to afford a substantial basis for the operation.

In the few cases of anuria recorded in which one kidney was obstructed and the other diseased but apparently unobstructed, incision and drainage of the unobstructed organ has afforded little or no relief. This is in accord with the disappointing results obtained from nephrotomy in urinary suppression due to causes other than stone, such as nephritis, corrosive sublimate poisoning, etc.

In conclusion I wish to lay emphasis on the following points:

1. Analysis of cases of calculous anuria recorded in the literature shows that at least in ninety per cent either only one actively functionating organ existed, which was blocked, or that there was blocking of both kidneys.

2. The few cases reported as examples of reflex inhibition of an unobstructed but more or less diseased kidney, as the result of calculous obstruction of its fellow, are to be explained more rationally as the functional failure of an overloaded unsound organ.

3. Convincing post-mortem and histological evidence of reflex inhibition of a sound kidney, as the result of calculous obstruction of its fellow, is lacking.

4. Convincing clinical and experimental evidence is likewise lacking.

5. From a practical point of view, then, calculous anuria should be considered and treated as a purely mechanical problem.

6. The therapeutic employment of the ureteral catheter should be restricted to a tentative use in mild cases only.

7. Operation should be resorted to at once in all urgent cases, the indication being to relieve obstruction, pyelotomy when practicable to be preferred to nephrotomy. Removal of the stone is an ideal to be attained whenever possible without undue prolongation of the operation.

8. Bilateral operation is indicated whenever the kidney first cut down upon seems inadequate by itself to sustain the work of elimination of the body. It naturally follows from this that the bilateral operation should be performed whenever the kidney first cut down upon is apparently found unobstructed.

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FINAL RESULTS (AFTER FIVE YEARS) IN 192 PATIENTS OPERATED UPON FOR ECTOPIC PREGNANCY; WITH SPECIAL REFERENCE TO SUBSEQUENT UTERINE AND REPEATED ECTOPIC PREGNANCIES[1]

By RICHARD R. SMITH, M. D., Grand Rapids, Michigan

TO learn what becomes of our patients operated upon for ectopic pregnancy, with the main idea of helping to establish a more rational basis for judgment as to whether in any given case we shall or shall not at the time of operation remove the opposite tube, has been the object of this inquiry.

If I may judge from a considerable amount of correspondence in my possession and from the numerous conversations I have had with surgeons, it would seem that a good deal of uncertainty exists as to the future course of such patients after their recovery from operation, particularly as to the frequency of subsequent normal pregnancies or a repeated ectopic one. This is quite excusable, for but few writers have busied themselves with this phase of the problem, and few with large experience have seemed to follow their cases for long periods. For the most part, surgeons have seemed to believe that normal pregnancies were very common and that repetitions were so infrequent as to be of little importance and, therefore, to warrant a uniformly conservative attitude in preserving whenever possible the childbearing function.

Because of this commonly held opinion, surgeons have, it appears, based their treatment of the opposite tube largely upon its apparent condition. It would seem that the general rule followed has been to examine it whenever the circumstances permitted, to remove it (and occasionally other diseased pelvic structures) if it were hopelessly closed or diseased, and to leave it if it appeared normal or capable of becoming so. Until recently my own course of action has been in accordance with this plan. However, after a more careful study of repeated ectopic pregnancy, I have somewhat modified my opinion and have come to the belief that whereas the general rule to preserve the opposite tube should usually be followed, it may be wiser to occasionally remove it, for repetitions have been frequent enough in such tubes to show us that in spite of its appearance we cannot safely prophesy as to its capabilities; *i. e.* whether it will normally transmit the ovum or not.

If I may judge from the literature and from my own experience, there is no one type of tube seen at such operations which from its appearance would seem on the one hand to make it especially disposed to a further ectopic pregnancy and give a sufficient reason for its removal; or, on the other hand, to warrant our safely assuming that such an accident would not recur and that a normal pregnancy, if any, would take place.

Whereas, under such circumstances, we are unable to correctly judge as to the capabilities of a patulous tube by its appearance, we do know that the woman who has once had an ectopic pregnancy is apt to repeat the process on the opposite side whenever the tube is patulous at the time of operation or capable of becoming so. The frequency with which this occurs is of greatest importance in making our decision in any given case as to whether it shall or shall not be left. Of fully equal importance are the facts concerning the frequency of subsequent normal pregnancies.

As to the frequency of normal pregnancies following an ectopic one, I did not have access at the time I began this study to the excellent work of Essen-Möller,[2] but I was led to believe from my own experience and from the little information that I could obtain from several others that their number was less than we had commonly supposed.

Essen-Möller, in his paper published two

[2] Essen-Möller. L'Obstetrique, Par., 1911, iv, 249.

[1] Read before the Section on Obstetrics, Gynecology and Abdominal Surgery, American Medical Association, Minneapolis, June 17, 1913.

years ago, deals with this question. Of his fifty-six cases he rules out seventeen:

One 49 years of age, seven operated that year, five in which both tubes were removed, two who died of tuberculosis, and two in which a microscopical examination of the tube showed no chorionic villi.

Of the remaining thirty-nine cases, eighteen (46 per cent) have had uterine pregnancies (seventeen with living children). He quotes Prochownik,[1] who had twenty-five normal pregnancies out of fifty-seven women, or 43.8 per cent, and Engström,[2] twenty out of forty-three, or 46.5 per cent. He expresses himself unqualifiedly in favor of not only preserving the opposite tube in all cases where it is not badly diseased, but of doing everything possible in rendering it capable of functionating normally. His own experience with repeated ectopic pregnancy has been small (two out of thirty-nine) and he regards this as a negligible factor. I do not believe he is entirely correct in this opinion, but that it is not only necessary to consider the frequency of subsequent normal pregnancies, but of repeated ectopic ones as well.

In gathering statistics two years ago for a paper on repeated ectopic pregnancy,[3] I found that there had been one hundred and thirteen recurrences in 2,998 cases gathered from the clinics in this country and abroad (a little less than 3.8 per cent). It was evident that this estimate was too low — first, because in large cities with a moving population it is almost impossible to follow patients for any extended period of time; second, no allowance was made for the nature of the operation performed; third, the age and the civil condition of the patient afterwards were not considered; and, fourth, the very important matter of lapse of time following operation was entirely left out of the account. It seemed reasonable to suppose that if our cases could be followed for a considerable period of time, and if we rightfully ruled out those in which for any reason further pregnancy was rendered impossible and confined ourselves to the ones in which a patulous tube was left, the percentage of recurrences would be much higher than this.

In order to obtain more accurate data, I have off and on for the past two years been carrying on a correspondence with a considerable number of surgeons in this country, and have obtained, from those men who were able to give me satisfactory statistics, an account of 192 patients that were operated upon more than five years ago.[4] I have asked these surgeons to give me the date of the operation, the age and civil condition at the time of operation, and to tell me what the condition of the affected tube was and what was done with it, and of the unaffected tube and how it was disposed of. They have obtained from the patients themselves, or through some reliable source, the facts as to subsequent uterine pregnancies, and whether they have had a repeated ectopic one. Their civil condition following operation was also noted and, in a general way, their present state of health and whether they had had any pelvic condition necessitating further operation. It is the result of this correspondence that I wish to give you. It is necessary first of all that any group of this kind be fairly representative of ectopic cases as a whole. I have included all cases operated five years ago or more *which have been traced* and in which the essential details were complete. I have thrown out those operated on less than five years ago, those that had not been definitely traced, those in which the essential details were incomplete, and a few isolated cases sent me that had been brought to the reporter's attention by some unusual incident, and which I did not think it fair to include.

I wish here to express my gratitude to those men who so willingly contributed to this work. No one except those who have undertaken it appreciates the amount of time, effort, and patience that the following up of old patients requires, and that they have done so willingly speaks well for the courtesy of the American

[1] Prochownik. Wien. med. Wchnschr., 1895, xlv, 1266; München. med. Wchnschr., 1900, lxiv.

[2] Engström. Mitt. u. d. gynak. Klin., i, 327.

[3] Smith, R. R. Am. J. Obst., N. Y., 1911, lxiv, 401.

[4] The five-year interval was selected rather arbitrarily. Had I selected a much longer one the number of cases reported would have been so reduced as to make the statistics lose much of their value. To make them absolutely accurate each case would have to be followed to the menopause, a thing which at the present time is manifestly impossible. For a first subsequent uterine pregnancy to occur later than five years following an ectopic one is rare. Also in 145 cases in which the interval between the two ectopics was given, I found that the average was almost exactly thirty months. In only fifteen instances was the interval longer than five years.

EXPLANATION OF TABLE.—The year of the operation given—month and day omitted. All 1908 cases were before June of that year. No special effort made to obtain reports on previous pregnancies and abortions—they are recorded as given. The year of a subsequent ectopic, pregnancy given whenever such was recorded. Civil condition following operation remained the same as far as was recorded, except when otherwise stated.

ANSPACH, DR. BROOKE M., Philadelphia, Pa.

No.	Date	Age	Prev. Preg.	Prev. Abort.	Condition and Disposal Opposite Tube	Condition and Disposal Affected Tube	Subsq. Preg.	Subsq. Ect.	Present Condition
1	'03	28	?	?	Not noted; emergency op. retained	Ruptured; removed with ovary	0	0	Cystic mass back of uterus in cul-de-sac size of egg
2	'08	?	?	?	L. hydrosalpinx; removed leaving ovary	Ruptured; removed with ovary	0	0	Health good
3	'08	35	?	?	Not recorded; retained	Unruptured; removed	3	0	Health good

BACON, DR. C. S., Chicago, Illinois

No.	Date	Age	Prev. Preg.	Prev. Abort.	Condition and Disposal Opposite Tube	Condition and Disposal Affected Tube	Subsq. Preg.	Subsq. Ect.	Present Condition
4	'93	28	1	0	Removed	Ruptured; removed	0	0	Fair; neurotic
5	'97	28	0	0	Normal; not removed	Ruptured; removed	1 abort. 3 ch.	0	Good
6	'01	25	0	1	Not recorded; retained	Ruptured; removed	1 ch.	0	Good
7	'02	32	2	0	Retained; not recorded	Ruptured; removed	0	0	Good
8	'98	30	1	0	Not noted; vaginal op.	Ruptured; infected; removed	0	0	Fair; neurotic
9	'97	34	1	0	Not noted; vaginal op.	Ruptured; removed; vaginal drainage	0	0	Fair; neurotic

BALLIN, DR. MAX, Detroit, Michigan

No.	Date	Age	Prev. Preg.	Prev. Abort.	Condition and Disposal Opposite Tube	Condition and Disposal Affected Tube	Subsq. Preg.	Subsq. Ect.	Present Condition
10	'06	22	?	?	Good; not removed	Tube and ovary removed	0	0	Good
11	'05	27	?	?	Good; not removed	Ruptured; tube and ovary removed	1	0	Good
12	'07	23	1	?	Good; not removed	Ruptured; removed	1	0	Good
13	'07	30	0	2	Healthy; not removed	Broken; removed	0	0	Good
14	'07 August,	25	1	?	Good; not removed	Perforated; removed	0	0	Good

1908, right adnexia removed for cystic condition and salpingitis.

BARRETT, DR. CHANNING W., Chicago, Illinois

No.	Date	Age	Prev. Preg.	Prev. Abort.	Condition and Disposal Opposite Tube	Condition and Disposal Affected Tube	Subsq. Preg.	Subsq. Ect.	Present Condition
15	'06	33	0	?	Adherent and thickened; not removed	Ruptured; removed	0	1 four years later	Good
16	'08	31	2	?	Slightly inflamed; not removed	Ruptured; removed	1	0	Good
17	'04	29	2	?	Old adhesions; not removed	Ruptured; abscess; six mos. pregnancy	0	0	Illeus following operation; drainage; recovery

Four years later removal of right tube and veneral hernia otomy.

BISSELL, DR. DOUGAL, New York, N. Y.

No.	Date	Age	Prev. Preg.	Prev. Abort.	Condition and Disposal Opposite Tube	Condition and Disposal Affected Tube	Subsq. Preg.	Subsq. Ect.	Present Condition
18	'07	28	1	?	Engorged; not removed		0	0	Good health
19	'07	46	8	?	Normal; not removed	Small gestation sac in middle of left tube	0	0	Good health

BOISE, DR. EUGENE, Grand Rapids, Michigan

No.	Date	Age	Prev. Preg.	Prev. Abort.	Condition and Disposal Opposite Tube	Condition and Disposal Affected Tube	Subsq. Preg.	Subsq. Ect.	Present Condition
20	20 yrs. ago	25	?	?	Healthy; not removed	Removed	0	0	Health good

BOLDT, DR. HERMAN J., New York, N. Y.

No.	Date	Age	Prev. Preg.	Prev. Abort.	Condition and Disposal Opposite Tube	Condition and Disposal Affected Tube	Subsq. Preg.	Subsq. Ect.	Present Condition
21	'05	26	?	?	Not removed	Removed	1	0	No ill effects

BRETTAUER, DR. JOS., New York, N. Y.
(Investigated and reported by Dr. Jellinghaus)

No.	Date	Age	Prev. Preg.	Prev. Abort.	Condition and Disposal Opposite Tube	Condition and Disposal Affected Tube	Subsq. Preg.	Subsq. Ect.	Present Condition
22	'02	26	3	0	Normal; not removed	Ruptured; tube and ovary removed	1	0	Good
23	'02	38	8	0	Diseased; tube and ovary removed	Ruptured; tube and ovary removed	0	0	Good, except menopause symptoms
24	'01	29	1	0	Normal; not removed	Ruptured; tube and ovary removed	0	'02	Good except menopause symptoms

BRETTAUER, DR., JOS., New York, N. Y. (Continued)

No.	Date	Age	Prev. Preg.	Prev. Abort.	Condition and Disposal Opposite Tube	Condition and Disposal Affected Tube	Subsq. Preg.	Subsq. Ect.	Present Condition
25	'03 Infl	25 ame	0 d fi	0 broi	Normal; not removed d following rece	Ruptured into broad ligament salpingoophorectomy, myomectomy and suspension nt delivery.	1 abort. 3 ch.	0	Good
26	'99	27	1	0	Normal; not removed	Unruptured; tube and ovary removed	0	'03	Good except menopause symptoms
27	'04	24	0	2	Normal; not removed	Ruptured; tube only removed	0	0	Good health
28	'04	26	0	0	Normal; not removed	Unrupt'd; tube only removed	2 ch.	0	Good health
29	'03 Hys	27 tere	1 c t o	2 my.	Inflamed; tube and ovary removed	Ruptured; tube and ovary removed	0	0	Good
30	'04	27	1	0	Normal; not removed	Unruptured; tube only removed	2 ch.	0	Good
31	'04 Pan	32 -hys	4 tere	1 c t o	Ovary cystic; tube adherent; tube and ovary removed my.	Cystic; pelvic peritonitis; tube distended	0	0	Good
32	'02	27	2	0	Normal; left intact	Ruptured; tube and ovary removed	0	'05	Good
33	'06	31	0	1	Norma; not removed	Unruptured; tube and ovary removed	0	0	Health good except prolapse
34	'05	30	1	0	Atrophied and nodular; not removed	Ruptured; tube and ovary removed	0	0	Good health
35	05	23	0	0	Normal; not removed	Ruptured; tube and ovary removed	0	0	Good
36	'06	23	0	1	Normal; removed	Ruptured; tube and ovary removed	1	0	No ill effects
37	'06	38	1	4	Tube infected; dermoid ovary; both removed	Ruptured; tube and ovary removed	0	0	Menopause symptoms; no other ill effects
38	'06	24	0	0	Normal; not removed	Ruptured; tube only removed	1	0	Health good
39	'06	39	7	0	Vaginal section	Hematocele			No ill effects
40	'02	26	1	0	Inflamed; tube only removed	Ruptured; tube only removed	0	0	No ill effects

BRETTAUER, DR. JOS., New York, N. Y. (Continued)

No.	Date	Age	Prev. Preg.	Prev. abort.	Condition and Disposal Opposite Tube	Condition and Disposal Affected Tube	Subsq. Preg.	Subsq. Ect.	Present Condition
41	'03	23	1	0	Cyst of ovary removed	Ruptured; tube and ovary removed	0	0	Menopause symptoms; flushes, etc., but continues to menstruate
42	'02	21	1	1	Normal; not removed	Ruptured; tube and ovary removed	3	0	Good health
43	'03	27	1	0	Normal; removed; panhysterectomy	Ruptured; intramural	0	0	Good except menopause symptoms
44	'97 1901	26 ; Tu	2 be at	0 site	Vaginal section neither tube inspected; nothing removed of old ectopic se	 at of hydrosalpi	0 nx; bo	04 th rem	Excellent oved
45	'04 Wid	38 ow si	1 nce	1 '08	Normal; not removed	Unruptured; tube and ovary removed	0	0	Excellent
46	'06	34	6	3	Not noted	Ruptured; removed	0	'07	Excellent
47	'05	27	2	1	Tube removed four months before for inflammation; now has follicular cysts	Ruptured; tube and ovary removed	0	0	Good
48	'06	30	2	1	Normal	Unruptured; tube and ovary removed	0	0	Good
49	'06	34	5	0	?	Ruptured; tube and ovary removed	0	0	Good
50	'05	30	5	0	Normal; not removed	Ruptured; tube and ovary removed	1	0	Good
51	'02	35	2	1	Normal; not removed	Ruptured; tube and ovary	0	0	Developed pelvic exudate left side soon after operation; conservative treatment; now o. k. except occasional pain left side

CURRIER, DR. ANDREW F., New York, N. Y.

No.	Date	Age	Prev. Preg.	Prev. abort.	Condition and Disposal Opposite Tube	Condition and Disposal Affected Tube	Subsq. Preg.	Subsq. Ect.	Present Condition
52	'02	25	3	0	Probably good from subsequent history	Not recorded	2 ch. 1 still born 3 abort.	'12	Health good

CURRIER, DR. ANDREW F., New York, N. Y. (Continued)

No.	Date	Age	Prev. Preg.	Prev. Abort.	Condition and Disposal Opposite Tube	Condition and Disposal Affected Tube	Subsq. Preg.	Subsq. Ect.	Present Condition
53	'96	32	2	1	Pus tube; removed	Tumor behind uterus; uterus and tube removed	0	0	Health good; operated in 1899 for ventral hernia following operation for ectopic
54	'97	30	1	0	Normal; not removed	Ruptured; removed	1 ch. twins	0	Good
55	'98	26	0	1	Bound down by adhesions; tube and ovary removed	Tumor in tube; tube and ovary removed	0	0	Health good, except menopause symptoms
56	'04	35	1	0	Enlarged; tuberculous Both tubes and	Tube and ovary adherent; tumor in proximal half ovaries removed	0	0	Health good as far as known

DAVIS, DR. EDW. P., Philadelphia, Pa.

No.	Date	Age	Prev. Preg.	Prev. Abort.	Condition and Disposal Opposite Tube	Condition and Disposal Affected Tube	Subsq. Preg.	Subsq. Ect.	Present Condition
57	'02	23	0	?	Apparently healthy; not removed	Ruptured; removed	0	0	Excessively fat and for some time had menorrhagia; general health been much improved by the use of thyroid extract and tonic does of strychnia

DE LEE, JOS. B., Chicago, Illinois

No.	Date	Age	Prev. Preg.	Prev. Abort.	Condition and Disposal Opposite Tube	Condition and Disposal Affected Tube	Subsq. Preg.	Subsq. Ect.	Present Condition
58	'06	28	1	?	Normal; not removed	Stump left open	0	0	No ill effects
59	'05	32	3		Apparently normal; not removed	Stump left open	1	0	No ill effects

DOANE, DR. PHILIP SCHUYLER, Chicago, Illinois

No.	Date	Age	Prev. Preg.	Prev. Abort.	Condition and Disposal Opposite Tube	Condition and Disposal Affected Tube	Subsq. Preg.	Subsq. Ect.	Present Condition
60	'01	27	1	m'y	Apparently normal; not removed	Ruptured; removed	abort. sev'al times	0	Good
61	'03	25	3	1	Apparently normal; not removed	Ruptured; removed	1	0	Good
62	'04	28	2	1	Apparently normal; not removed	Ruptured at outer third; removed	0	0	Good

DOEDERLEIN, DR. THEO. J., Chicago, Illinois

No.	Date	Age	Prev. Preg.	Prev. Abort.	Condition and Disposal Opposite Tube	Condition and Disposal Affected Tube	Subsq. Preg.	Subsq. Ect.	Present Condition
63	'07	25	5	0	Removed Subtotal hyster	Removed ectomy.	0	0	Perfect health

FINDLEY, DR. PALMER, Omaha, Nebraska.

No.	Date	Age	Prev. Preg.	Prev. abort.	Condition and Disposal Opposite Tube	Condition and Disposal Affected Tube	Subsq. Preg.	Subsq. Ect.	Present Condition
64	'08	27	4	?	Healthy; not removed	Ruptured; removed	1	0	

GELLHORN, DR. GEO., St. Louis, Mo.

No.	Date	Age	Prev. Preg.	Prev. abort.	Condition and Disposal Opposite Tube	Condition and Disposal Affected Tube	Subsq. Preg.	Subsq. Ect.	Present Condition
65	'05	26	?	?	Normal; not removed	Unruptured; salpingectomy	1	0	Diabetes
66	'05	40	2	?	Normal; not removed	Unruptured; removed with ovary	0	0	Good
67	'06	24	0	0	Occluded; salpingostomy	Ruptured; tube and ovary removed	0	0	Good health
	Acu	te ap	pen	dicit	is; operated Dec	. 16, '09; tube a	gain oc	cluded	; salpingostomy
68	'07	32	0	0	Occluded; salpingostomy	Unruptured; tube and ovary removed	0	0	Good health

GOFFE, DR. J. RIDDLE, New York, N. Y.

No.	Date	Age	Prev. Preg.	Prev. abort.	Condition and Disposal Opposite Tube	Condition and Disposal Affected Tube	Subsq. Preg.	Subsq. Ect.	Present Condition
69	'03	33	2	?	Normal; not removed	Removed, leaving both ovaries	1	0	Good

GREEN, DR. CHARLES M., Boston, Mass.

No.	Date	Age	Prev. Preg.	Prev. abort.	Condition and Disposal Opposite Tube	Condition and Disposal Affected Tube	Subsq. Preg.	Subsq. Ect.	Present Condition
70	'00	27	1	?	Not removed	Unruptured; removed	3	0	Good

LOCKHART, DR. F. A., Montreal, Canada

No.	Date	Age	Prev. Preg.	Prev. abort.	Condition and Disposal Opposite Tube	Condition and Disposal Affected Tube	Subsq. Preg.	Subsq. Ect.	Present Condition
71	'01	40	2	?	Healthy	Ruptured; tube and ovary removed	0	0	Good
72	'99	36	5	?	Diseased; removed	Ruptured; tube and ovary removed	0	0	Good
73	'01	31	4	?	Healthy	Ruptured; tube only removed	1	0	Good
74	'01	21	1	1	Healthy	Ruptured; tube and ovary removed	0	0	Good
75	'02	23	?	?	Diseased; removed	Ruptured; tube and ovary removed	0	0	Good
76	'05	30	?	?	Diseased; removed	Ruptured; tube and ovary removed	0	0	Good

LOCKHART, DR. F. A., Montreal, Canada (Continued)

No.	Date	Age	Prev. Preg.	Prev. abort.	Condition and Disposal Opposite Tube	Condition and Disposal Affected Tube	Subsq. Preg.	Subsq. Ect.	Present Condition
77	'05	23	2	?	Diseased; removed	Ruptured; tube and ovary removed	0	0	Good
78	'06	24	3	?	Chronicly inflamed; removed	Ruptured; removed	0	0	Good
79	'06	26	?	?	Healthy	Ruptured; removed	1	0	Good
80	'06	28	2	?	Hematosalpinx removed	Ruptured; tube and ovary removed	0	0	Good
81	'01	28	0	1	Healthy	Unruptured; removed	0	0	Good
82	'04	31	2	1	Healthy	Aborted; removed	2	0	Good
83	'07	38	6	2	Inflamed	Pan-hysterectomy.	0	0	Good
LYONS, DR. JOHN A., Chicago, Illinois									
84	'90	22	?	?	Normal; not removed	Ruptured; removed	0	0	Good
McLEAN, DR. MALCOLM, New York, N. Y.									
85	'95	38	4	?	Apparently normal	Ruptured; removed	1 plac. prae full term	0	Good health
86	'98	37	0	?	Apparently normal	Ruptured; removed	0	0	Good health
87	'00	33	2	?	Apparently normal	Ruptured; removed	1	0	Good health
MANTON, DR. WALTER P., Detroit, Mich.									
88	'03	32	0	0	Apparently normal; not removed	Ruptured; removed	0	0	Good
MANWARING, DR. J. B., Flint, Mich.									
89	'04	24	1	0	Enlarged and adherent; not removed on account patient's condition	Removed	0	0	Good
	Had pelvic inflammation two months after operation from remaining tube.								

METCALF, DR. WM. F, Detroit, Mich.

No.	Date	Age	Prev. Preg.	Prev. Abort.	Condition and Disposal Opposite Tube	Condition and Disposal Affected Tube	Subsq. Preg.	Subsq. Ect.	Present Condition
90	'07	36	9	?	Not removed	Ruptured into broad ligament, removed	0	0	Good
91	'03	26	0	1	Abdominal hys	Ruptured tero-salpingo-oophrectomy.	0	0	Not known
92	'04	26	2	?	Adhesions about tube; abdominal	ruptured hysterectomy	0	0	No data
93	'03	33	2	1	Chronic inflammation and kinked	Ruptured; removed	0	,04	Good
94	'05	30	1	2	Adhesions; otherwise normal; not removed	Pregnant in uterine cornu; appendage removed	0	0	Good or fair
95	'07	41	1	?	Pelvis filled with pus level to umbilicus; abdominal hysterectomy		0	0	Good
96	'06	36	?	?	Normal; removed Both ovaries fibro-cystic.	Ruptured; 2½ months' preg.	0	0	Good
97	'06	32	0	0	Hydrosalpinx; Pelvic adhesions; hystero-salpingo-oophrectomy.	Ruptured; abdominal	0	0	Good
98	'05		2	?	Adherent; not removed	Ruptured; removed	1 abort.	0	Good
99	'05	26	1	?	Tube removed; ovary fibro-cystic	Removed ovary fibro-cystic	0	0	Good
100	'05	30	?	?	Adherent	Ruptured; placenta adherent in cul-de-sac	0	0	Good
	Abdominal hysterectomy; double salpingo-oophorectomy.								
101	'04	39	2	?	Dermoid cyst Abdominal hys	Ruptured tero-salpingo-oophrectomy.	0	0	Good
102	'03	23	1	?	Apparently normal	Early pregnancy; blood streaming from ampullar portion; removed	0	0	Good
103	'03	37	0	1	Hydrosalpinx; cystic ovary; removed	Tubal pregnancy and mole; removed	0	0	Good
104	'06	28	2	1	Hydrosalpinx; distal end removed	Removed	0	0	Good

MILLER, DR. C. JEFF, New Orleans, La.

No.	Date	Age	Prev. Preg.	Prev. Abort.	Condition and Disposal Opposite Tube	Condition and Disposal Affected Tube	Subsq. Preg.	Subsq. Ect.	Present Condition
105	'99	23	1	0	Healthy	Ruptured; removed	0	0	Good
106	'06	39	5	1	Apparently healthy	Ruptured; removed	0	0	Good
	Fift	een pus tom	mon colle s an	ths a ctio d pa	fter operation p n on opposite si ssing period one	atient was opera de freed. This d week.	ted thr evelop	ough t ed afte	he vagina and a r acute symp-
107	'08	34	2	1	Apparently healthy	Ruptured; removed	0	0	Good except dysmenorrhoea
108	'07	37	1	0	Apparently healthy but long	Ruptured; removed	0	0	Good
109	'07	35	0	0	Apparently healthy but long	Ruptured; removed	0	6 mos. later	Good

MONTGOMERY, DR. E. E., Philadelphia, Pa.

No.	Date	Age	Prev. Preg.	Prev. Abort.	Condition and Disposal Opposite Tube	Condition and Disposal Affected Tube	Subsq. Preg.	Subsq. Ect.	Present Condition
110	'08	33	5	?	Normal; not removed	Sac formed by tube and ovary both removed	0	0	Good
111	'08	25	?	?	Not stated	Tube and ovary removed	2	0	Good

NEWELL, DR. FRANKLIN S., Boston, Mass.

No.	Date	Age	Prev. Preg.	Prev. Abort.	Condition and Disposal Opposite Tube	Condition and Disposal Affected Tube	Subsq. Preg.	Subsq. Ect.	Present Condition
112	'04	24	?	1	Normal; not removed	Removed with ovary	1 ch. 1 abort.	0	At present some pelvic symptoms mass in left side of pelvis; no operation
113	'05	35	6	?	Normal; not removed	Ruptured; removed	0	0	Good
114	'03	31	3	?	Cond. not stated; ligated; not removed	Cond. not stated; removed by vagina with ovary	0	0	Good health
	Ope	rate d for	app	endicitis and he	rnia in scar Oct	ober, 1	909.		
115	'05	30	2	?	Not stated; tube resected	Enlarged and ruptured; removed	0	0	No subsequent operation
116	'05	32	2	?	Probably left in situ	Removed	0	0	No subsequent operation
117	'04	33	1	?	Probably left in situ	Ruptured; removed	0	0	No subsequent operation
118	'06	28	0	?	Prolapsed and adherent; left in situ	Adherent but unruptured; removed	0	0	Good health

NEWELL, DR. FRANKLIN S., Boston, Mass. (Continued)

No.	Date	Age	Prev. Preg.	Prev. Abort.	Condition and Disposal Opposite Tube	Condition and Disposal Affected Tube	Subsq. Preg.	Subsq. Ect.	Present Condition
119	'05	36	6	?	Probably left in situ	Enlarged; bleeding from fimbriated end; removed	0	0	Health good
120	'01	28	2	2	Not stated	Ruptured; removed with ovary	0	0	Health good
121	'07	38	6	?	Normal: not removed	Ruptured and bleeding; removed	1	0	Health good except for post-operative hernia
122	'05	36	0	?		Ruptured	0	0	Good condition
	Mul	tiple	fibr	oids	of uterus; uter	us and both tub	es rem	oved.	
123	'06	46	4	?	Probably left in situ	Pelvic hemato-cele; drained by vagina	0	0	No subsequent operation
124	'02	32	4	?	Normal; left in situ	Removed with ovary	0	0	Health good
125	'04	35	?	1	Adherent; left in situ	Ruptured; removed	0	0	No subsequent operation
126	'01	33	2	?	Probably left in situ	Buried in organized clot; removed with ovary	0	0	Health good
127	'04	39	2	?	Probably left in situ	Pelvic hemato-cele; drainage from below	0	0	Health good

PETERSON, DR. REUBEN, Ann Arbor, Mich.

No.	Date	Age	Prev. Preg.	Prev. Abort.	Condition and Disposal Opposite Tube	Condition and Disposal Affected Tube	Subsq. Preg.	Subsq. Ect.	Present Condition
128	'05	28	2	1	Hematoma of ovary and pus tube; ovary and tube removed	Ruptured; tube and ovary removed	0	0	Good
129	'03	27	0	4	Normal; not removed	Unruptured; removed	0	0	Menstruated regularly for year and a half; since then periods of amenorrhoea, lasting three or four months during which she has neuritis
130	'04	36	1	2	Adherent; tube and ovary removed	Unruptured; tube and ovary removed	0	0	Good
131	'01	30	0	1	Adherent; tube and ovary removed	Ruptured; tube and ovary removed	0	0	Good
132	'06	24	1	1	Vaginal drainage Not lived with	husband since o	p.		Good health

PETERSON, DR. REUBEN, Ann Arbor, Mich. (Continued)

No.	Date	Age	Prev. Preg.	Prev. Abort.	Condition and Disposal Opposite Tube	Condition and Disposal Affected Tube	Subsq. Preg.	Subsq. Ect.	Present Condition
133	'07	30	0	2	Adherent; not removed	Unruptured; removed	0	0	Exopthalmic goitre
134	'01	22	0	?	Adherent; adhesions broken up; not removed	Ruptured; removed	0	0	Not well
	Well recently.	for two	year	s; then bladder t	rouble; operated	for thi	s; stro	ke of paralysis	
135	'02	26	0	?	Adherent; removed	Unruptured; removed	0	0	Good; suffers some from stomach and nerves
136	'02	27	sing	le	Adherent; adhesions broken up; not removed	Unruptured; removed	0	0	Good
137	'02	30	0	?	Adherent; not removed	Ruptured; removed	0	0	Good
138	'02	33	0	3	Dense adhesions in pelvis Both tubes and	Dilated but not ruptured ovaries remove	d. 0	0	Good but not as strong as before operation
139	'02	33	0	1	Normal; not removed	Adherent; removed	1	0	Good health

ROBB, DR. HUNTER, Cleveland, Ohio

No.	Date	Age	Prev. Preg.	Prev. Abort.	Condition and Disposal Opposite Tube	Condition and Disposal Affected Tube	Subsq. Preg.	Subsq. Ect.	Present Condition
140	'00	35	3	?	Adherent to ovary and broad ligt. removed	Ruptured; ligated both ways with silk; stump cauterized	0	0	Good
141	'06	43	4	?	Enlarged and adherent; removed	Aborted old ectopic; removed	0	0	Good
142	'05	37	3	1	Adherent to uterus and ovary; removed	Ruptured; removed	0	0	Good

SMITH, DR. RICHARD R., Grand Rapids, Mich.

No.	Date	Age	Prev. Preg.	Prev. Abort.	Condition and Disposal Opposite Tube	Condition and Disposal Affected Tube	Subsq. Preg.	Subsq. Ect.	Present Condition
143	'00	22			Vaginal operation		0	0	Good
144	'03	36	3	?	Not recorded	Ruptured on bringing it up; tube and ovary removed	0	0	Good
145	'05	21	?	?	Normal; not removed	Enlarged; tube removed leaving ovary	2 ch. 1 ab.	0	Good

SMITH, DR. RICHARD R., Grand Rapids, Mich. (Continued)

No.	Date	Age	Prev. Preg.	Prev. Abort.	Condition and Disposal Opposite Tube	Condition and Disposal Affected Tube	Subsq. Preg.	Subsq Ect.	Present Condition
146	'06	31	1	?	Old clots around appendage otherwise normal; not removed	Right appendage included in mass tube and ovary removed	0	Yes	Good
147	'05	31	0	?	Normal; not removed	Ruptured; removed, leaving ovary	0	'11	Some pelvic trouble twice otherwise well
148	'06	32	?	?	Slight thickening at end: small cyst of ovary; tube and ovary left intact	Large mass in extreme end: showed point of rupture; tube and ovary removed	0	0	Good
149	'07	32	1	?	Normal; not removed	Contained large mass; tube removed	0	0	Good

STEVENS, DR. EDMUND H., North Cambridge, Mass.

No.	Date	Age	Prev. Preg.	Prev. Abort.	Condition and Disposal Opposite Tube	Condition and Disposal Affected Tube	Subsq. Preg.	Subsq Ect.	Present Condition
150	'89	23	0	0	Normal; not removed	Ruptured; tube and ovary removed	3	0	Good
151	'90	36	1	?	Normal; not removed	Ruptured; removed	1	0	Good
152	'91	33	Not Married until three years after		Normal; not removed	Ruptured; removed	0	'92	Good
153	'91	23	0	0	Bound down by adhesions from pelvic peritonitis	Ruptured; removed	0	'92	Good
154	'92	30	2	?	Normal; not removed	Ruptured; removed	0	0	Good
155	'92	36	4	?	Normal; not removed	Ruptured; removed	1	0	Good
156	'96	37	1	?	Cystic; removed	Ruptured; removed	0	0	Good
157	'96	39	3	?	Normal; not removed	Ruptured; removed	0	0	Good
158	'96	22	0	?	Apparently normal; not removed	Ruptured; removed	0	'98	Not good; nervous
159	'97	38	?	?	Had been removed two years before	Ruptured; removed	0	0	Good
160	'97	29	?	?	Adherent to ovary; not removed	Ruptured; removed	0	0	Good

STEVENS, DR. EDMUND H., North Cambridge, Mass. (Continued)

No.	Date	Age	Prev. Preg.	Prev. Abort.	Condition and Disposal Opposite Tube	Condition and Disposal Affected Tube	Subsq. Preg.	Subsq. Ect.	Present Condition
161	'98	36	4	?	Apparently normal; not removed	Ruptured; removed	2	0	Good
162	'98	39	1	?	Apparently normal	Ruptured; removed	0	0	Good health until death in 1909
163	'00	34	1	?	Doubled on itself; cyste removed	Ruptured; removed	0	0	Poor health
164	'00	24	0	1	Adherent to appendix; filled with pus removed	Ruptured; removed	0	0	Good Health
165	'01	31	?	?	Normal in appearance	Ruptured; removed	0	'03	Good
166	'01	36	1	?	Normal in appearance	Ruptured; removed	2	0	Good
167	'03	32	1	?	Normal in appearance	Ruptured during office examination	4 abort.	0	Good
168	'04	22	Unmar	n-ried	Normal in appearance	Eroded; ovum and clot in tube; tube split and clot removed	0	0	Good
169	'06	28	1	?	Normal in appearance	Ruptured; removed	1 abort.	0	Good
170	'08	33	0	?	Normal in appearance	Ruptured; removed	0	0	Good

STONE, DR. ISAAC S., Washington, D. C.

No.	Date	Age	Prev. Preg.	Prev. Abort.	Condition and Disposal Opposite Tube	Condition and Disposal Affected Tube	Subsq. Preg.	Subsq. Ect.	Present Condition
171	'99	34	0	?	Not removed	Ruptured; tube and ovary removed	2	'07	Good
172	'98	25	1	?	Good; not removed	Ruptured; removed	0	0	Good
173	'00		0	?	Good; not removed	Ruptured; removed	0	0	Good
174	'97		1	?	Not removed	Ruptured; removed	0	0	Good
175	'93	28	0	0	Thickened; not removed	Removed	0	0	Good

TAUSSIG, DR. FREDERICK J., St. Louis, Mo.

No.	Date	Age	Prev. Preg.	Prev. Abort.	Condition and Disposal Opposite Tube	Condition and Disposal Affected Tube	Subsq. Preg.	Subsq. Ect.	Present Condition
176	'06	27	3	?	Apparently healthy	Ruptured; removed	0	0	Good
	Subsequentafelttack of salpingitis;					mass size of lemon; well in four weeks; mass			

VINEBERG, DR. HIRAM N., New York, N. Y.

No.	Date	Age	Prev. Preg.	Prev. Abort.	Condition and Disposal Opposite Tube	Condition and Disposal Affected Tube	Subsq. Preg.	Subsq. Ect.	Present Condition
177	'99	29	4	2	Normal	Not stated; removed	0	'02	Good
178	'02	30	0	?	Normal; not removed	Ruptured; matted with ovary and broad lig't	0	'07	Good
179	'02	28	1	?	Normal; not removed	Ruptured; removed	0	'10	Not known
180	'03	40	Last chd 14 yrs. ago	?	Not noted on account patient's condition Associated with uterine pregnancy.	Ruptured; foetus placenta and tube in blood tumor in cul-de-sac; tube removed	0	0	Good
181	'04	30	1	?	Covered with omentum; apparently normal; not removed	Dilated to size of orange; removed	1	0	Good
182	'07	28	1	?	Normal	Enlarged and congested; removed with ovary	1	0	Good
183	'03	25	1	?	Not stated	Not stated; removed	0	'08	Good
184	'05	28	0	0	Normal	Blood clot dilating tube entire length; adherent to broad ligament posteriorly; ligated near uterus; removed leaving ovary	2 ab. due to incessant emesis	0	Good
185	'04	28	0	0	Normal	Enlarged and ruptured; removed	1	0	Good
	Associated with uterine pregnancy, going on to term.								
186	'04	40	Last 7 yrs. ago	?	Normal; left intact	Ruptured; placenta and tissue adherent to fimbriated end; tube removed	0	0	Good

WATKINS, DR. THOMAS J., Chicago, Ill.

No.	Date	Age	Prev. Preg.	Prev. Abort.	Condition and Disposal Opposite Tube	Condition and Disposal Affected Tube	Subsq. Preg.	Subsq. Ect.	Present Condition
187	'04	33	0	?	Pyosalpinx; excised	Ruptured; excised	0	0	Good
188	'05	33	2	2	Normal; not removed	Ruptured; excised	0	Yes	Good
189	'05	35	?	1	Absent*	Ruptured; excised	0	0	Good

*Patient operated soon after marriage for double tubal occlusion following abortion

WATKINS, DR. THOMAS J., Chicago, Ill. (Continued)

No.	Date	Age	Prev. Preg.	Prev. Abort.	Condition and Disposal Opposite Tube	Condition and Disposal Affected Tube	Subsq. Preg.	Subsq. Ect.	Present Condition
190	'05	34	?	?	Normal; not removed	Ruptured; removed	0	0	Good
191	'07	29	0	?	Normal; not removed	Ruptured; removed	0	0	Good
192	'07	33	2	?	Old salpingitis; excised	Ruptured; excised	0	0	Good

surgeon and the interest he has in learning the truth. The entire list of cases reported by each man will be published with this paper.

Let us first dispose of the matter of morbidity subsequent to operation. In the 188 cases in which reports are made as to the present health (four cases health not stated but other details given), it is described as "excellent," "good," or "fair," in 145 instances. All who have had anything happen that was worthy of note, even though their present condition of health be satisfactory, have been excluded from this number. These terms must, of course, be accepted in their ordinary sense and would vary somewhat in meaning, according to the understanding of the reporter as to what was meant by the question. As stated, these women have had nothing of note occur (normal pregnancies excepted) and are well in the ordinary meaning of the term.

Six patients are suffering from ailments of a more or less serious character, not traceable to the ectopic pregnancy or operation, including one patient with exopthalmic goiter (Peterson) six years after operation, and one (Gellhorn) with diabetes eight years after operation.

Besides these, the following deserve special mention:

One patient had operation for appendicitis three years afterwards, and an occluded "opposite" tube, upon which a salpingostomy had been done at the original operation, was found again closed and was reopened. No pregnancies since operation seven years ago. (Gellhorn.)

One had operation six years later for acute appendicitis and for a hernia in the scar. Health now good. (Newell.)

One has ventral hernia — not operated. (Newell.)

One had ventral hernia repaired — health now good. (Currier.)

One had operation on the bladder — details not given; not well since; a stroke of paralysis lately. (Peterson.)

One had operation for "cystic condition of the ovary and salpingitis"— right adnexa removed. (Ballin.)

One had indefinite pelvic symptoms (two ectopics; no children)—no examination. (Smith.)

Three have at present induration or masses in the pelvis and more or less pelvic symptoms, but no operation advised. (Anspach, Newell and Taussig.)

One had pelvic inflammatory condition from remaining tube. (Manwarring.)

One has uterine prolapse. (Brettauer.)

One has fibroid, now inflamed, following recent childbirth — three children since ectopic. (Brettauer.)

One had ileus following operation; operated four years later — removal of remaining tube and repair of ventral hernia. (Barrett.)

One in which there was a question as to whether patient did or did not have a repeated ectopic fifteen months after the first operation. Patient was operated per vaginam and a pus collection on the opposite side evacuated. This had developed after acute symptoms and one week after a missed period. (Miller.)

One died eleven years after operation of unknown cause — health until then good. (Stevens.)

Those who had a second ectopic will be discussed later. No effort was made to obtain the immediate mortality from operation and where such reports were sent me they were excluded from the list.

The final results from operation, excluding the cases of repetition to be mentioned, were, it appears, very satisfactory. But very fev of these patients have suffered any serious inconvenience in subsequent years from their ectopic pregnancy or operation, and a large number doubtless owe their lives to the intervention.

As suggested at the beginning of this paper, there are two things in the future course of these patients which interest us most of all, more so since we commonly have them directly within our control at the time of operation — one the question of further normal pregnancy and the other that of repetition of a tubal one. If the opposite tube is hopelessly closed and the condition of our patient permits, the general rule is to remove it (and perhaps other diseased organs), and few would seriously question this procedure. A very large percentage of our ectopic cases remain sterile following operation (in this list, 97 out of 144 in which pregnancy might conceivably occur). How much the repair processes that follow the extravasation of often large quantities of blood, especially when long retained, may have to do with this is a question. As a rule, however, these conditions are much less persistent than follow a pelvic infection involving the same structures. Even after most extensive extravasations, pregnancy not infrequently takes place, so that we may well afford to deal conservatively with the remaining tube if further pregnancy is desirable and the tube itself in good condition. It is usually considered advisable to gently separate the adhesions about these tubes when such are present. Engström has done this in six cases resulting in normal pregnancy, and Prochownik has seen the same results four times in his series.

Although salpingostomy and other plastic operations have not yielded very encouraging results, they might perhaps be tried.

But what if we leave a normal, patulous tube, or one that we are capable of releasing and perhaps making so? Knowing that the same accident may occur in such a tube that is left, our only reason for leaving it, the patient's condition permitting, is that it will make possible a normal uterine pregnancy. What does the future of this class show in our series of cases? There are here 192 cases traced for a period of five years or more. Of these, forty-eight had operations of a nature to preclude further pregnancies, or had already had the other tube removed.

12 had hysterectomies.
31 opposite tube removed.
3 opposite tube had previously been removed.
1 distal end removed for hydrosalpinx, making pregnancy very improbable.
1 tube ligated but not removed.

In this list no opposite tubes were, according to our records, removed except for disease. These cases must, of course, be completely excluded from consideration in estimating further pregnancies. There is no justification for including them.[1]

[1] In those cases in which the record of the condition and disposal of the opposite tube was not complete, we have assumed that it was retained and, therefore, that pregnancy was possible. Eight of these were vaginal sections.

The inquiry into the civil condition of the patient after operation would seem to indicate that this factor in the occurrence of subsequent pregnancy should not be taken seriously into account.

This leaves 144 in which a pregnancy was conceivably possible. Forty-seven of these women have had uterine pregnancies, or 32.6+ per cent (forty-two with living children, sixty-four children in all; one stillborn, five aborting without children, five had abortions and children), ninety-seven had none. There were twenty-one cases of repeated ectopic pregnancy, half as many as had living children. Two women had subsequent children and a repeated ectopic. Of the sixty-seven women under thirty years of age, twenty-seven had subsequent uterine pregnancies, ten had a repeated ectopic pregnancy. Of the seventy-four women above thirty, nineteen had subsequent uterine pregnancy, and eleven had a repeated ectopic. In three cases age (not given, but tube retained), one of these had a subsequent pregnancy.

If, then, much less than half of our ectopic cases have children subsequently (Essen-Möller 46 per cent, Prochownik 43.8 per cent, our figures 32.6 per cent), and 14.6 per cent repeat their ectopic, leaving out the few women who have had further inflammatory trouble with the opposite tube, is it best to always save the opposite tube when it seems capable of transmitting the ovum? Each man must answer this question for himself, according to his convictions on the matter of preserving the childbearing function and the seriousness that he attaches to a further ectopic pregnancy. He will, according to his habit, defer little or much to the wishes of the patient in the matter; but whatever his action, it should be determined after serious consideration of these facts. In young women the desirability of preserving the childbearing function is of greatest importance. In time and with the advent of children, this desirability ordinarily diminishes. In the beginning it overrules all but the most serious considerations and would lead us always to conservation; later other less serious considerations (mainly the possibility of a second ectopic pregnancy) must be taken into account.

In other pelvic lesions we ordinarily maintain a most conservative attitude in our younger patients — later we do not hesitate to remove the possibility of children if the preservation of the necessary organs threatens to implicate her health. Why should we not do the same with our ectopic cases? Would we not best serve her interests by removing the possibility of a repetition of this distressing accident when the need of children is no longer so urgent? With these patients, as with all others in whom an operation which may involve the childbearing function is considered, I believe we should discuss the matter freely with her and be governed to a certain though limited extent by her wishes. Not the favorable appearance of a tube, but the future history of such recorded cases should be the basis for our judgment. Her age, the number of children she has borne, her general health and her wishes as to further pregnancies should all enter into this consideration. If she then has another tubal pregnancy, we shall at least have a good excuse for having deliberately submitted her to its serious possibilities. Personally, I am now removing the opposite tube in those women in whom, for reasons suggested above, childbearing is no longer desirable — in others I preserve it.

EXCISION OF THE CLAVICLE AND FIRST RIB FOR MALIGNANT DISEASE

By R. E. FORT, M D., Nashville, Tennessee

MUCH doubt exists as to whom credit should be given for the honor of first completely excising the clavicle. Treves (1) gives McCreary of Kentucky priority, 1811. Gross (2) credits Remmer as the first operator in 1732. Zabel (3) credits Moreau and D'Angerville of Paris with the first total excision in 1765, and claims that the operation of Remmer was without doubt, a partial, not a total, extirpation. Heyfelder (4) gives Meyer the credit of the first in 1823, and Cassebohn with the first partial extirpation in 1719, and Coley (5) credits Valentine Mott with the first in 1828.

Without attempting to harmonize this conflict of authorities as to who is entitled to this honor, we were astonished to find reports of only sixty-four total excisions, one of excision of the clavicle and sternal ends of the first and second ribs, "Morfitt's Case" reported by Carson (6) and no reported cases of total excision of the clavicle and the first rib.

It is the writer's object to report a case of excision of the clavicle and first rib, but it will not be amiss to notice some of the important facts concerned in the literature of excision of the clavicle. Mott in his report says, "This operation far surpasses in tediousness, difficulty, and danger anything that I have ever witnessed or performed. It is impossible for any description which we are capable of giving to convey an accurate idea of its formidable nature." Velpeau (7) calls the operation "a daring attempt never carried into effect except in a few cases of operation upon the shoulder," yet he says, "There are circumstances sufficiently numerous which require this operation if we wish not to abandon the sufferers to certain death." C. Norkes (8) collected thirty-two cases of excision for malignant tumors, of which twenty-four were sarcoma, five reported as carcinoma, two exarthrosis, and one chondroma, with six deaths. Coley states that the cases reported as carcinoma were probably sarcoma, as primary carcinoma of the clavicle is unknown.

Since 1893, Coley has collected thirty-two additional cases, making a total of sixty-four.

The immediate mortality of excision of the clavicle is between sixteen and eighteen per cent, but the end-results, or those who die from recurrence, is quite seventy per cent. The results, however, are sufficiently hopeful to make immediate surgical intervention not only justifiable but mandatory.

The types of tumors observed by pathologists have been varied,—periosteal, round-cell; periosteal, spindle-cell; osteosarcoma, small round-cell, spindle-cell; myeloid, round-cell; myelogenous, chondroma; embryonic, myeloid; myeloid fibrous and fibro-plastic, and my own osteosarcoma, giant-cell.

Ages of patients. Two between one and ten years, twenty between ten and twenty, nine between twenty and thirty, twelve between thirty and forty, seven between forty and fifty, one between fifty and sixty, and three between sixty and seventy.

Diagnosis. A study of the reported cases makes it quite clear that the diagnosis must be made early if there is to be a probability of saving the patient. No variety of tumor is more malignant than a majority of sarcomata of the clavicle. The vascularity of the neck insures early infiltration and rapid generalization. The history of antecedent trauma is important. Seven of the nine cases observed by Coley gave histories of trauma. In most cases the swelling will be noted very soon after the receipt of the injury. In its early stages, it is usually hard, smooth, and immovable.

Tuberculosis. Tuberculosis is a condition from which sarcoma must be differentiated. "A history of tuberculosis in the family, or tuberculosis in some other portion of the body, would justify us in ruling out sarcoma" (Coley). It is also to be noted that primary tuberculosis of the clavicle is extremely rare.

and sarcoma is prone to occur in strong and healthy individuals, and more often in the young than in the middle-aged and old.

Syphilis. This is a rare condition in the clavicle, so where no other bone is involved, where the clinical diagnosis is reasonably indicative of sarcoma, especially where the tumor has appeared in a young person showing rapid growth, excision should be done without excising a portion of the tumor for microscopical examination, thereby giving the opportunity for localized infection. It is usually impossible to make a satisfactory frozen section for the reason that decalcification must first be made. We would advise total extirpation, as partial extirpation of any bone for sarcoma is incomplete surgery. Coley, Richardson, and others advise treatment with the mixed toxins of erysipelas and bacillus prodigiosus as a prophylactic against recurrence. Coley claims that it is entirely free from danger, and this has been my observation, but frankness compels me to state that my results from its use in sarcoma in other bones have been disappointing. Bearing in mind, however, the statements of Coley that it is without danger, and that in cases of sarcoma of the long bones generally in which toxins have been used, recurrences have been less than one-third as frequent as in cases in which they have not been used, justification for its use in all cases would seem apparent.

Results after excision. In two cases there was recurrence in four years after operation, in two within eighteen months, in one case sarcoma of the femur developed three months after operation, in one case there was local recurrence within six months, in one recurrence was immediate, in one sarcoma recurred in the upper jaw nine months after operation, in three cases recurrence was within three months, in seven recurrence occurred within six months, two were well five years after operation, one case well one year, one case well seven months, one case fifty years, and the case reported below well six months after operation.

A. B., age eleven years, mother living, father died by violence; no family history of tuberculosis or syphilis. Patient a fairly well developed boy, no Hutchinson's teeth or other evidence of congenital syphilis. Tumor of clavicle was noticed eight months before he presented himself. At five months he was seen by another surgeon who cut down on the tumor, chiseled it away as best he could, and submitted the specimen to Dr. Wm. Litterer who reported giant-cell osteosarcoma. The wound healed, but the tumor rapidly reproduced itself, and when he presented himself to us July 23, 1913, a tumor the size of an English walnut was attached to the inner third of the clavicle and first rib. It was hard, smooth, and firmly attached at its base, with no history of trauma.

The diagnosis of malignancy having already been made, we advised its immediate removal. A T-shaped incision was made, from the sternum along the lower border of the clavicle, to the coracoid process of the scapula, and from the upper portion of the sternum to the upper border of the second rib. The skin over the tumor was removed by an elliptical incision, and realizing the danger of division of the clavicle, disarticulation was made from the sternum and first rib, the cervical fascia and sterno-mastoid muscle incised well above the tumor until the middle portion of the clavicle was reached; here the trapezius muscle was separated from its clavicular attachments close to the bone. The same method was used below. The clavicle was lifted from its sternal end and separated from the mediastinum, the pleura, the subclavian vessels and ligaments by gauze and scissor dissection. The rib was not disarticulated from the sternum, separating it from the scalenus medius and intercostal muscles, the mediastinum and the pleura by blunt dissection; the close proximity of the subclavian vessels passing through the subclavian grooves of the first rib was the most tedious part of the procedure. A small abdominal retractor was padded with gauze and the vessels held up by an assistant during the removal of the outer part of the rib. The dissection completed to its vertebral attachment, some difficulty was encountered in disarticulation; finally this was accomplished by inserting blunt scissors into the articulation and severing the ligament. The tumor was sufficiently close to the sternum for me to indulge in the fear that this bone had become affected. Consequently we removed about one-half of the sternum from its upper portion to upper portion of the second rib. The safety of this procedure was, I think, guaranteed by the separation of the mediastinum from the posterior surface of the sternum and its protection with gauze. I can conceive no more important step of this operation than the protection of the pleura and mediastinum from wound, as a large percentage of immediate fatalities have been caused by infection of these cavities. The wound was closed by approximating the cervical fascia, the sternomastoid and the trapezius muscles above, and the deltoid and fibers of the pectoralis major muscles below. The skin was closed and approximation of the internal half of skin secured by a flap from below.

A cigarette drain was inserted at the middle portion of the wound; no vessel was tied throughout the operation. Time of operation, one hour and forty-five minutes. There was no injury to either the mediastinum or the pleura, consequently there was no infection.

The patient sat up on the fourth day, and made an uninterrupted recovery, leaving the hospital on August 18th, having gained ten pounds in weight. After ten days the use of the left arm was encouraged. The two features which impressed us most were the free use of the arm, and the absence of deformity of the left chest. In the absence of the scar it would be hard to detect the side upon which the excisions had been done. Toxins of erysipelas and bacillus prodigiosus were given in increasing doses until the dose was established, and this dose was persisted in for two months after operation.

A letter received from his uncle, Dr. J. D. Bryant of Fayetteville, Tennessee, dated December 3d, reports that he is going to school, growing, and has no evidence of recurrence. He also reports that he shucks corn, harnesses the horses, hauls wood with his goat and wagon; in fact, he can see no deficiency in the left shoulder.

CONCLUSIONS

First, primary sarcoma of the clavicle is a rare condition, and the earlier the diagnosis and the more radical the treatment, the better the chances for complete recovery.

Second, the writer is of the opinion that partial excision of the clavicle or first rib should not be practiced for malignant disease.

Third, the danger of local or general metastases is very great, and as division of the bone increases this hazard, excision should be made with the bone intact.

Fourth, because of the favorable results obtained in the few cases of sarcomata of the clavicle and the larger number of sarcomata of the long bones, it is advisable to use the mixed toxins of erysipelas and bacillus prodigiosus for two or three months after operation.

Fifth, under modern aseptic conditions the mortality for excision of the clavicle and excision of the first rib should be comparatively small, and, considering the fate of the patients who are denied surgery, the opportunity of relief by surgery is mandatory.

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ORIGINAL SURGICAL USES OF THE BONE-GRAFT[1]

A Report of Two Hundred and Fifty Cases

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THIS report of original surgical uses of the bone-graft is a supplement to the following communications which appeared in the Folder of the American Orthopedic Association, May 15, 1911; Journal of the American Medical Association September 9, 1911, and August 3, 1912, p. 353; The Post-Graduate, November, 1912, xxvii, No. 11; Author's Stereo-Clinic, published by Southworth Co.; American Journal of Surgery, January, 1914, and Zeitschrift f. Orthopädische Chirurgie, xxxi.

This paper is based upon an experience gained from 253 human bone-graft cases over a period of three years, also a large amount of animal experimentation devoted to the study, both macroscopic and microscopic, of the bone-graft when used in ways similar to the technique employed in the human cases.

The following technique of applications of the bone-graft involves the author's original usage, so far as the writer is informed, with the exception of three incidences.

These cases have been operated in the past three years, and include 178 cases of Pott's disease, sixteen wedge-graft corrections in case of congenital club-foot, seventeen inlay grafts for ununited fractures of the long bones, fourteen cases of paralytic foot deformities; the remaining twenty-eight cases include bone-graftings for fixation of tubercular ankle, repair of osteomyelitic cavities, transplanting astragalus for absent head and neck of femur, the correction of paralytic drop-wrist, deformity of the tibia following fracture, underdevelopment of the jaw, fixation of tubercular knee, reënforcing the bony deficiency and muscular weakness in spina bifida, in conjunction with arthroplasty for paralytic dislocation of the hip, congenital dislocation of the hip, paralytic scoliosis, restoring depressed nasal bridge, fixation of tubercular sacro-iliac joint, ununited fracture of the spine, ununited fracture of the femoral neck, congenital absence of tibia, replacing bone deficiency following removal of osteosarcoma, mobilizing ankylosed hips and carpus by the use of osteocartilaginous grafts.

Enough time has not elapsed in some of the later cases to be able to draw trustworthy conclusions as to their ultimate results. But as our early cases have proved the permanency of the graft and result up to three years, and as other observers have followed bone-graft cases even as long as thirty years, we believe that the reliability and permanency of the bone-graft has been sufficiently proven.

We agree, also, with McWilliams that the periosteum on the graft plays an important rôle in aiding to establish a more abundant and earlier blood supply or nutrition to the graft, as I have previously stated.[2]

The endosteum and the marrow substance also serve a similar purpose to the periosteum, either acting as a ready medium through which the bone transplant gets its nutrition, or, in case the bone-cells in the graft die, furnishing living active cells through which the graft is regenerated

The membranes covering cortical bone act largely as the physiological media through which these cortical cells naturally get their nutrition; again, their loose structure is very favorable to taking up nourishment or establishing vascular means to that end with the environment in which they are placed. Therefore, the wisdom of including these structures on all grafts is obvious. Attention should also be called to the fact that the bone-graft stimulates an active osteogenesis on the part of the recipient bone itself, therefore contributing further in this way toward the assurance of permanency of result.

The execution of the technique involved in the application of the bone-graft in many

[2] J. Am. M. Ass., 1913, April 5th.

[1] Read before the Congress of German Surgeons, April 14th, 1914. Berlin, Germany.

of the conditions enumerated above would be difficult, slow and inexact, except for the adaptation of the electric motor and the author's attachments, such as special twin saws, drills, burrs and doweling instrument. These save time, avoid traumatism both to bone and soft tissue, favor precision in molding the graft and preparing its bed, simplify and make easier the technique in deep wounds and regions difficult to get at with hand tools (Fig. 1).

A rapidly revolving motor instrument, according to Crile's kenetic theory, should diminish shock on account of the lessened excitation of the afferent nerves from a rapidly moving instrument and consequently the minimum resultant disturbance to the nerve centers.

From clinical observation it is apparent that whatever shock occurred when hand bone-cutting instruments were used has largely, if not entirely, disappeared since the development and use of the motor instrument. Whether this is due to the marked shortening of the time of operation or to Crile's theory or to both, and in what proportion, it is very difficult to demonstrate.

The impossibility of obtaining actual immobilization of diseased vertebræ in Pott's disease by any external means, whether by spinal brace, plaster of Paris jackets or recumbency, was the chief stimulus which caused the author to resort to the bone-transplant as the simplest and most trustworthy means of actually immobilizing the diseased vertebræ.

Additional advantages of internal fixation by the bone-graft are obvious, such as the correction of the kyphosis in suitable cases, and the prevention of progression of deformity by controlling the leverage action of the involved vertebræ. It accomplishes this by its splint action and by preventing the separation of the posterior ends of the lever which are the spinous processes. This prevents the approximation or crushing together of the anterior arms of the levers which are the bodies. This is most important, as crushing of the vertebral bodies due to superincumbent weight, muscular spasm and respiratory action is a most important factor in causing the prolongation of the convalescence of Pott's disease.

It is also believed that internal bony immobilization of a tubercular joint, in conjunction with a proper régime of life for tuberculous patients, is the most ideal treatment. This is immediately obtained by use of the bone-graft as herein described (Fig. 2).

Calve and Lelievre[1] confirm Minard's statement that osseous tissue affected by tuberculosis is never restored from the diseased parts, and that if partially destroyed vertebral bodies are held apart for a long time by plaster of Paris jackets or other external support, they will come in contact again and the kyphosis will recur when these supports are removed. This is an additional convincing reason for the use of the bone-graft in producing a bony union by implanting it into the uninvolved posterior segment of the vertebræ with the kyphosis corrected and the diseased vertebral bodies separated.

The perfected technique of the author's operation for Pott's disease, ununited fractures of the spine, etc, is as follows (Fig. 3). With the patient in the ventral position, the tips of the spinous processes are reached by a curved incision and turning up of a flap of skin and subcutaneous tissues. With a scalpel the periosteal tips of the spinous processes are split in the center, also the supraspinous ligament. The interspinous ligaments are next split into approximately equal parts, to a depth of about one-half inch (12.70 mm.), varying with the age and the size of the patient, without disturbing their attachments to the spinous process. Very little hæmorrhage results, because only dense ligamentous tissues are incised, which is in considerable contrast to the hæmorrhage resulting from the separation of the muscles from the spinous processes in a deeper operation, such as a laminectomy, etc. With a thin sharp chisel or author's osteotome and mallet each process is split longitudinally into equal parts for a depth of about one-half inch (12.70 mm.), care being taken that greenstick fractures are produced on one and the same side of all the spinous processes so split. The unbroken halves

[1] Am. J. Orthop. Surg., 1913, Oct.

preserve intact the leverage of these processes. A separation of the halves of each spinous process produces a gutter into which the transplant is later placed. In all cases the full thickness of the tibial cortex is included with the periosteum, endosteum and attached marrow substance, thus producing a transplant with approximately a rectangular cross-section.

It has been found advisable for bone-grafts for all purposes to include periosteum and endosteum, as it is through these media that cortical bone largely receives its nourishment. Thus the graft approximates a complete organic structure, with its normal means of distributing nourishment, and the early establishment of blood supply is enhanced.

A graft of this thickness necessitates producing a full fracture of one half of the spinous process and setting it over laterally in order to place it deep enough to be well covered with the above-mentioned ligaments. It is important that the spinous processes be split *in situ* with all the ligamentous and muscular insertion undisturbed as in this way none of the natural supports of the spine are taken away and the ligaments afford, by means of strong ligatures, an excellent medium for firmly fixing the bone-splint in place.

The depth to which the spinous processes are split varies as to age, size of patient, and amount of pressure atrophy from former apparatus, etc., which may so reduce the spinous processes as to present mere tubercles on the posterior aspect of the neural arches and in certain instances can be split in depth only three-sixteenths to one-fourth of an inch (4.75 to 6.35 mm.), but this affords good bone contact, and as the graft is embedded into longer spinous processes at either end, it affords the usual efficient fixation. A hot saline pack is placed over the back wound until the bone insert is obtained.

With the patient still in the ventral position, the leg is flexed on the thigh and an incision over and down to the crest of the tibia is made. The fascia and subcutaneous tissues are carefully separated from the periosteum of the anterior-internal flat surface of the tibia. From its crest and anterior-internal aspect a strip of the tibia is removed with a motor saw. A motor saw affords a very rapid and exact method of securing the graft and is used exclusively for this purpose. The length of graft varies according to how many vertebræ are to be spanned, *i. e.*, all those diseased and two healthy ones on each side, if in the dorsal region, and one on each side if in the lumbar region, its breadth from one-fourth to five-eighths inch (6.35 to 15.85 mm.), its thickness from three-sixteenths to three-eighths inch (4.75 to 15.51 mm.), according to the size of the patient. The graft is inserted between the halves of the interspinous ligaments and the spinous processes with its edge anterior or innermost, and its cut side or marrow side in contact with the unbroken halves of the spinous processes. It is held firmly in position by interrupted sutures of heavy or medium kangaroo tendon, which are passed through the supraspinous ligament and posterior edges of the halves of the interspinous ligaments near the tips of the spinous processes, beginning at the center of the graft. The ligaments are then drawn over the insert posteriorly by tense sutures placed closely together. Before tying the last sutures the posterior corners of the ends of the graft are removed by the rongeur forceps, and these fragments of bone, with others, are cut into small pieces and placed under and about each end of the graft; the ends of the graft are then drawn down and sutures tied. This is important as it furnishes multiple foci for a rapid proliferation of bone, as, according to Macewen, the smaller the graft the greater the relative bone growth. If there is a moderate kyphosis of short duration, it is entirely obliterated; any kyphosis of a few years or less duration becomes much diminished, either at the time of operation or during the first few days after, from the corrective effect of the lateral tension of the graft.

This sequence of the technique is important because, by preparing the back wound first and packing it with a hot saline compress, we secure hæmostasis, and control the blood-clot about the graft, a condition to be desired.

A certain amount of blood-clot is desired as it facilitates bone growth. The serous ooze which takes place from the several tissues furnishes a good culture medium for the bone-graft. This medium, blood, serum or plasma, has been sought in preparing tissue cultures for the microscopical study of cellular bone-growth. Cold abscesses about the spinous processes are rare, but when found do not usually interfere with satisfactory union. Where a kyphos is too great for implanting a straight splint properly in place in the spinous processes, the approximate contour of the knuckle is obtained by bending a silver probe over the tips of the spinous processes. The curved probe is then laid upon the anterior-internal aspect of the tibia as a pattern, and a graft of the desired shape, width and thickness is outlined in the periosteum with a scalpel. The graft, however, is always straighter than the kyphosis and the spine is straightened by usual pressure and drawn to the bone-splint by means of the heavy ligatures. When the deformity is too great, even for this method, the graft is placed with its wider diameter in a lateral rather than anterior-posterior plane, and then bent into place between the halves of the spinous processes and held with heavy kangaroo tendon, as above indicated.

This bending is accomplished by making numerous saw-cuts one-half to two-thirds the way through. These cuts not only shape the graft to the kyphos, but also favor a rapid establishment of blood supply and the throwing out of bone callus from the graft itself. The cross cuts, one-eighth to three-eighths inches (3.17 to 9.51 mm.) from each other, are always made on the marrow side. The transplants vary in size from four to seven and one-half inches (10.16 cm. to 19.05 cm.) in length, one-fourth to one-half (6.35 to 12.70 mm.) in width, one-fourth to three-eighths inch (6.35 to 9.51 mm.) in thickness. Care is taken that the insert has some bone marrow. The importance of this has been pointed out by several German investigators. Before placing the unbent graft in its bed, its periosteum is incised in many places, so as to allow the underlying osteogenetic cells exit for proliferation, and also an entrance of blood supply to the graft. The graft, firmly embedded under tension in the spinous processes and the dense intraspinous ligaments, afford immediate and excellent fixation of those vertebræ involved even before union takes place. This is confirmed by the immediate disappearance of pain in adults, and pain and night cries in children. The environment of the spinal insert is most favorable: it is not only wedged into healthy spinous processes, which are less than three-fourths inch (19.05 mm.) apart, but is also surrounded throughout its entire extent by ligamentous tissue which is normally attached to bone. The conditions are favorable to a rapid establishment of an haversian blood supply from the spinous processes to the graft. The writer believes that the fact that the spinal graft rarely shows any evidence of disintegration or absorption is explained in this way. Where the kyphosis is marked and angular, greenstick fractures of both halves of the prominent spinous process are produced with this osteotome, and their tips turned in laterally and sutured in contact with posterior surface of the transplant. This produces additional bone contact for graft and reduces the kyphosis by so much.

Post-operative treatment. Although it is known from experimental work that the graft becomes united by bony union in four weeks, nevertheless the patient is confined in the recumbent position on a fracture bed for six to eight weeks. After this he is allowed to walk about without apparatus for part of the day. Where a straight graft of sufficient length is used, there is no necessity for a plaster jacket or support. In dorsal cases, where a deformity has developed, necessitating pronounced bending of the graft, a spinal support may be advisable for a few months. It should be emphasized that these cases should be under the observation of a surgeon experienced in this line of work throughout their whole convalescence. The relief of pain and acute symptoms is most satisfactory. External spinal supports, as plaster jackets and braces, should always be avoided, not only on account of their interference with normal function of respiration, but also on account of their injurious effect on

the graft itself, not only from pressure, but in interfering with its function and the stimulus derived therefrom. This is realized by every investigator of bone work.

Indications for operative treatment. Fixation by the bone-graft is indicated in all cases, at all ages, where pain or muscle spasm demand immobilization of the diseased vertebræ, and the earlier the operation the more favorable the prognosis. It is indicated for the prevention and correction of increasing deformity, and is even more urgent in the presence of complicating conditions such as psoas spasm, cold abscess or paraplegia.

The only special contra-indication is the inability to secure a clean field of operation. This, however, is rare, as these cold abcesses seldom point in or invade the region of the spinous processes. Uninfected cold abscesses between the spinous processes, however, have not interfered with primary union.

Prognosis. The prognosis in all operated cases is most favorable as to relief of all symptoms and increase of deformity. Correction of deformity is most favorable in cases operated early and cases of longer duration where kyphosis is sharply angular or presents a considerable amount of motion. In the one hundred and seventy-eight cases operated, a surprising amount of respiratory mobility was noted in the center of the kyphosis, in all early cases, and in a considerable percentage of cases of even four to six years' duration. These observations were made after the spinous processes were exposed and while the patient was lying prone on a firm surfaced operating table, breathing quietly under an anæsthetic. Under these conditions slight motion only could be detected between the healthy vertebræ above and below the kyphosis. The undoubted reason for this increased motion in the diseased area is the loss of support due to the destruction and absorption of the diseased vertebral bodies, leaving only the lateral masses with their facets and the spinous processes to support the column.

Paralytic scoliosis. In cases of very flexible paralytic scoliosis, uncontrollable when the trunk is in the vertical position, where there are sharp angular curves, a graft has been implanted in six to eight of the tips of the transverse processes of the convex side, at the apex of the sharpest curve, after straightening, in a similar manner as that in applying the graft (author's) to Pott's disease.

The treatment of these cases, otherwise impossible to control by external supports such as plaster jackets, corsets or braces, has been much facilitated.

The graft, however, acts only as an adjunct to external supports.

Spina bifida. In cases of spina bifida (Fig. 4), where the meningocele has been controlled and a large deficiency of vertebral bone exists, together with weakness, as evidenced by lordosis or other deformity, the bone-graft offers an excellent means for strengthening the weakened spine from the congenital bone deficiency.

The technique is somewhat similar to that adopted in Pott's disease. Modification is necessary on account of the absence of spinous processes and parts of neural arches. The spinous processes above the cleft and the lateral masses of the last lumbar vertebra and the first part of the sacrum are reached from each side by two curved skin incisions, as it is undesirable to interfere with the nerve-tissue which is usually involved in the cicatrix following the operative reduction of the meningocele. The second spinous process above the cleft is split longitudinally and a green stick fracture produced in each half. The first spinous process above the cleft is denuded of its muscular and ligamentous attachments and both sides freshened. Below the cleft the lateral masses of the fifth lumbar vertebra, or the congenitally deformed stumps of the neural arches if sufficiently prominent, and the first segment of the sacrum, which is usually congenitally hypertrophied, are split with the osteotome, and the halves separated to receive the lower ends of the two grafts.

The wounds are packed with a saline compress and the two grafts are prepared and removed from the crest of the tibia, long enough to reach from the split spines above to the sacrum below. The upper ends are beveled, so that when these beveled surfaces come together the grafts form an acute

angle, like an inverted V. The grafts are placed at this angle in the beds prepared for them, and held firmly in place at their bony contacts by drawing the split ligaments over them with interrupted sutures of medium kangaroo tendon. The technique is similar to that of the bone-graft applied for Pott's disease. Skin wounds are closed, and the patient placed on a fracture bed for six weeks.

Fracture of the spine. In cases of persistent non-union following fracture of the spine, presenting pain, disability and increasing deformity, the bone-graft is indicated, and should be inserted as for Pott's disease.

It is also indicated in fresh fractures of the spine, spondylitis traumatica (Kümmell's disease) and neuropathic spine (Charcot), where, on account of a rarefying osteitis, crushing of the vertebral bodies and increasing deformity is likely to produce cord compression.

Tuberculosis of the sacro-iliac joint. The prognosis of tuberculosis of the sacro-iliac joint, when treated by conservative methods, is most unfavorable. Tubby states that 7.9 per cent only recovered in the moist type when treated by conservative means, in a series of thirty-eight cases. As in the case of bone and joint tuberculosis elsewhere, the prognosis is more favorable in children than in adults. This joint is most unfavorable for external splint fixation, largely on account of its anatomical architecture. Its joint surfaces are oblique, inclining from above downward, forward and outward. Its strength is wholly dependent upon its ligaments. It furnishes no chance for leverage control.

The sacrum, on account of its extreme inclination, is at the disadvantage of being an inverted key to an arch.

Conservative treatment is best carried out by the double Thomas hip splint or the double plaster of Paris spica in conjunction with recumbency during the acute stage.

Internal bone fixation offers the only satisfactory means of immobilization, on account of the above-mentioned anatomical conformation, together with the very powerful muscle action which affects this joint (Fig. 5).

The following technique has been devised by the author for using the bone-graft in this condition and has furnished most satisfactory results: The posterior-superior spine of the ilium, the wing and first posterior spine of the sacrum are reached by a curved incision. The posterior border of the wing of the ilium and the spinous process are split, with their attached ligaments, by a thin osteotome, forming a gutter to receive the ends of the graft.

If practical, a surface on the sacrum is denuded to furnish additional contact with the graft. The wound is packed with a saline compress, and with the patient still in the prone position, the leg is flexed and a graft of sufficient length is removed from the crest of the tibia by the motor saw, as described in the use of the bone-graft in Pott's disease. The width of the graft should be three times the thickness of the cortex. The thickness should include the whole cortex, periosteum, endosteum, and a small amount of the adhering marrow. The graft is placed in its prepared bed, and the ligaments drawn over it by interrupted sutures of medium kangaroo tendon. The skin wound is closed and the patient placed on the back in a fracture bed, for a period of not less than five weeks. There should be no necessity of further mechanical treatment.

In cases of non-union and certain fresh fractures of the vertebræ, when displacement and cord pressure have not occurred, the bone-graft as applied by the author in Pott's disease is applicable for support and fixation.

An illustrative case is that of a young woman, referred by Dr. E. H. Johnson of Naugatuck, Conn. She sustained, in a railroad accident, a horizontal fracture through the middle of the body of the eleventh vertebra. Plaster of Paris jackets were worn continously for one year, at the end of which time support was so necessary that whenever the cast became soft the patient complained of pain and lack of support and asked for a fresh jacket. The tips of the tenth, eleventh, and twelfth spinous processes were exposed through a circular incision to the right turning up the flap of the skin and subcutaneous tissue. These spinous processes were split *en masse* with the attached supra- and interspinous ligaments, with a

scalpel, thin chisel and mallet. A graft of sufficient length was removed from the crest of the right tibia and inserted in the cleft. The split ligaments, with the embedded fragments of the spinous processes, were drawn over it by means of interrupted sutures of medium-sized kangaroo tendon. The patient was kept on a fracture bed for five weeks. The support from graft thus embedded gave immediate relief although no plaster of Paris jacket was applied. At this writing, one year later, there is no evidence of pain or lack of support.

Ununited fractures. I have often said that the Lane plate and other internal metal splints, when applied to ununited fractures of long standing, are a hindrance rather than an advantage in securing bony union. This view has been strengthened by the accumulation of experience.

The indications for treatment in fresh fractures and ununited fractures are entirely different, although it is very evident, from the discussion of these problems with various men and the large number of failures seen in our clinics, that many practitioners do not appreciate this difference.

In a large percentage of fresh fractures temporary fixation only is necessary to insure union, as the osteogenetic function of the fragments is active and in the presence of accurate apposition union occurs rapidly. The proper application of the Lane plate in suitable cases may fulfill all requirements.

In ununited fractures the problem is quite different. We have here in the ends of the fragments a marked diminution or an entire cessation of osteogenetic activity. This cessation of activity is evidenced in the marked sclerosis or eburnation which is always found.

The pathology of this condition of sclerosis is very similar to that found in non-ankylosing osteo-arthritis where there is an overdeposit of calcium salts, and a consequent diminution and degeneration of bone-producing cells. The therapeutic requirements of these pseudo-arthroses are fixation, stimulation of osteogenesis on the part of the fragments, and an osteogenetic scaffold connecting the active bone in each fragment back of the eburnated areas. The bone-graft, when inlaid according to the herein-described technique, is the only means of fulfilling these requirements. Two, if not all, of these three essentials are necessary in order to secure union.

The Lane plate furnishes but one of these, viz., temporary fixation, but at the same time it causes absorption and disintegration of bone. The bone transplant not only produces fixation, but also stimulates callus-formation and grows bone on its own part.

Abundant evidence has accumulated to prove that something more than fixation is necessary in these conditions. The most favorable cases for external fixation, such as fracture at the middle third of the tibia, with the fibula intact, have failed to unite in spite of months of effectual splinting and recumbency in bed. Operation showed no interposition of soft tissues and there was no evident reason for non-union.

Codivilla appreciated the above-mentioned therapeutic requirements and met them partially by spanning the fractured area with a very thin autogenous periosteal graft, which has given in the hands of others a fair percentage of good results. But it was not an ideal procedure in that it did not furnish efficient fixation, it did not stimulate osteogenesis between the ends of the fragments, because it was entirely superficial, and it did not penetrate cortical bone structure. Being extra-osseous, it therefore furnished an imperfect graft environment.

Murphy has evolved a better method in his use of an intramedullary dowel, which furnishes more effectual fixation and being entirely intra-osseous, favors stimulation of osteogenesis by better contact of graft to recipient fragments. It is, however, difficult thus to get contact to active bone beyond the sclerosed area, which is most important. It is also difficult of application in small bones, such as those of the forearm, where the medullary canals are small. As in the case of the intramedullary aluminum splint of Elsberg, it is most difficult to secure the necessary lateral fixation in fragments, in such cases as fractures of the ulna and radius, where these bones have been contractured together during long existing non-union.

An illustrative case that will be mentioned later was that of an ununited fracture at the middle of the radius of four years' duration. After four unsuccessful operations, including Lane plating, the radial fragment ends were found closely contractured to the side of the ulna. They were freed with difficulty and held in proper alignment by a long inlay bone-graft. On account of the strong tendency of the angulation to relapse the necessary lateral fixation would have been impossible by any intramedullary splint. The problem was easily solved by the leverage action of a long inlay bone-graft. It is always difficult to get a tight fit of the intramedullary splint into both fragments.

The technique applied in twelve of my cases, namely, fractures of the tibia, shaft of the femur, radius and humerus, was as follows: The fractured area was exposed by a generous skin incision. When the fractured bone is superficial, as in the case of the tibia, the incision is made lateral to the intended site of the bone insert. The skin and subcutaneous tissue are retracted, the bone ends are developed and freshened with chisel, motor burr, or saw, and the sclerosed bone plug is removed from the medullary canal.

If there is overlapping of the fragments the amount of pull required to correct it varies with the degree of overriding at the site of fracture. In the case of a fractured femur in a muscular man, as much as a one hundred and fifty pounds pull may be necessary to secure sufficient extension. In this instance it is far better to set up and adjust a traction pulley apparatus with heavy weights, or use the Hawley fracture table. Either of these provides a constant and uninterrupted pull. If the fragments still overlap and sufficient extension cannot be made to bring them together, it is necessary to trim off the fragments with motor burr, saw, or chisel until good position can be secured. This will produce shortening, but it cannot be avoided.

The fragments are now held in good alignment by an assistant. The periosteum is divided with a knife longitudinally over the bone to be removed in making the gutter for the bone insert. Periosteal flaps are turned back to either side, exposing the bone (Fig. 6).

Two parallel saw cuts, about three-eighths of an inch (9.51 to 12.70 mm.) to one-half inch apart, are made longitudinal in the fragment ends completely through the bone cortex to the marrow cavity with a motor twin circular saw (Fig. 1). The distance between the saw-cuts is arranged by adjusting the distance between the twin saws. These cuts are made from two and one-half to three inches (6.35 to 7.62 cm.) into the end of each fragment from the line of fracture.

While the fragments are held in good alignment, they should always extend far enough from the line of fracture to reach well into the non-sclerosed active bone of either fragment. This distance is subject to considerable variation, depending upon the site of fracture and the amount of eburnation present. The distance the twin saws should be apart, i. e., the width of the gutter for the graft, should be from 5/16 to 8/16 of an inch (7.93 to 12.70 mm.), according to the size of the bone. The revolving saws are kept constantly bathed in saline solution by a spray connected with a sterile tube to a fountain syringe. This prevents the development of excessive heat from friction, which should always be avoided on account of its devitalizing effect upon peripheral bone-cells.

After the twin saws have traveled the desired length to make the gutter for the graft, the bone fragments between the saw-cuts are removed by severing the ends distal from the point of fracture with a narrow osteotome in such a manner as to effect a tongue and groove joint with the ends of the graft (Fig. 10). With motor driven drill holes are bored in the cortex on either side of the gutter, slanting inward to the marrow cavity. These holes are placed near the line of fracture so as to fix the center of the insert. The ends of graft are secured in position by the above-mentioned tongue and groove joint, when feasible, or by additional sutures. This joint is very quickly shaped, and the greater the muscular contracture the more securely is it held in place (Fig. 7).

The exact length of the desired insert is obtained by measuring the gutter and transferring this measurement to the exposed anterior internal surface of the opposite tibia.

A flexible probe is usually satisfactory for this purpose, a right-angled bend marking the exact measurement.

The wound and gutter are packed with hot saline compresses while the graft is being prepared. The patient remaining in the dorsal position, the graft-yielding tibia is exposed by an incision over its crest. The overlying structures are retracted, and the size and shape of the graft are outlined in the periosteum by means of the scalpel with the probe measure as a guide. With the twin saws adjusted to the same distance apart as when forming the gutter, bone cuts are made to the marrow cavity along the antero-internal tibial aspect. With a narrow osteotome or small motor-driven saw or burr the graft is now dislodged and the ends grooved with the motor saw to fit the triangular tongue of the gutter ends.

A double strand of heavy kangaroo tendon is passed through the drill holes previously made. One strand in each fragment is now pulled up from the bottom of the gutter and the graft is placed under them. Traction is exerted on the limb and the graft is forced into position.

A good fit is assured because the same adjustment of twin saws is maintained both in forming the gutter and in removing the graft, and they must be of equal and uniform width through their whole extent. Traction is now removed and the elasticity of the soft parts force the tongue and grooved ends into tighter adjustment. The kangaroo fixing sutures are then drawn taut and tied over the graft.

It is readily seen that this not only affords most effectual fixation but also furnishes a most ideal environment for the bone-graft. It brings each structural layer of bone-graft into close apposition with its corresponding layer in the recipient fragment, namely, periosteum to periosteum, cortical bone to cortical bone, endosteum to endosteum, and marrow substance to marrow substance. Periosteum, and when possible endosteum and marrow substance, are always included in the graft. We have proved by animal experimentation that this close contact of haversian systems assures permanent viability at least of a large portion of the insert. The bone which has been removed from the ends of the graft in order to form the above-mentioned grooves and other normal bone-fragments are finely chipped with a rongeur and pushed between and placed about the ends of the fragments at the line of fracture wherever possible.

These act most effectively as supplementary foci of osteogenesis. Macewen has well pointed out that the osteogenetic efficiency of a bone-graft varies in inverse ratio to its volume. The smaller the graft the greater the relative osteogenesis.

The site of the fracture is covered with the periosteal flaps which were reflected to expose the bone to be removed. This gives two layers of periosteum covering the transplanted fragment. The overlying tissues and skin are closed without drainage. The leg wound is closed in a similar way except that the adjacent muscles are drawn into the cavity from which the graft was taken. Splints are applied and not removed before five weeks.

ILLUSTRATIVE CASES

Case 1. M. S., female, 45 years old, always healthy. Four years previously she fell, fracturing the right radius at the junction of the middle and distal thirds, the ulna remaining intact. Fragments reduced under ether. No union occurring in eight weeks, fracture was cut down upon and muscle freed from the bone ends. Good apposition was secured but no union followed. A second open operation was performed and the fragments nailed together. Again no union resulted. At a third open operation the fragments were wired, but again no union followed. Two years after the fracture, at a fourth operation, Lane plates were applied, and this also was followed by non-union. Two years later, four years after the fracture, the patient in desperation consulted me to determine whether something further could not be done, for her arm was both painful and useless.

November 7, 1913 (Fig. 8), the fracture was cut down upon and the Lane plate was found loose in the periosseous tissue. Tips of the screws were found in large circular cavities in bone from which they had loosened. There was a depression in the side of the fragment ends where the metal plate had caused an absorption of bone. The radial fragments, as shown in Figs. 3 and 4, were much shortened from the previous operations and the metal contact, and badly angulated towards the ulna. Their ends were made fresh and with much difficulty their alignment was corrected. This caused the

fragments to retract from each other about an inch. The periosteum on the outer side of each fragment was incised distally from the fracture for two and one-half inches and retracted, exposing the bone.

By means of the motor saw and osteotome a gutter was made in the fragments, according to the above-described technique, about three-sixteenths of an inch (4.75 mm.) wide and three and one-half inches long.

With the motor saw a graft three and one-half by seven-sixteenths by three-sixteenths inches (8.89 cm. by 11.09 mm. by 4.75 mm.) was removed from the anterior internal aspect of the tibia and trimmed with the saw so that it fitted tightly into the gutters in each fragment.

The strong tendency of the angular deformity to relapse was prevented, and the fragments were held very securely by the heavy kangaroo bone suture previously described. A plaster of Paris cast was applied and upon its removal five weeks later firm union of the fragments had occurred in good position (Fig. 6).

CASE 2. H. C., male, 28 years old, in an automobile accident in Scotland, April 5, 1911, sustained a fracture at the middle third of the right tibia and fibula. The fracture was reduced and placed in a plaster of Paris splint. Seven weeks later no union had occurred and Bier's hyperæmia was applied for four months at a hospital in Scotland. No union resulted. One year after the fracture, with non-union, I cut down on the tibia and inlaid a graft five inches long according to the above-described technique. It was not deemed necessary to disturb the fibula. In five weeks firm union had occurred. Excellent function existed twenty months after operation.

UNUNITED FRACTURE OF NECK OF FEMUR

In cases of ununited fracture of the neck of the femur the bone-graft is even more necessary than in the shaft of long bones, for here the mechanics, blood supply, and osteogenetic conditions are much more unfavorable to union.

This is exemplified by the case of a young woman who received a fracture of the neck of the femur and four months later non-union was evident. The pseudo-arthrosis was cut down upon, the ends of the fragments were freshened, and the fragments were held together by a long square tin-plated spike driven through the great trochanter and neck into the head. A long plaster of Paris spica was worn for ten weeks. Primary union of the soft tissues resulted. Much bone absorption about the spike occurred and non-union resulted.

The above experience, among others, has induced the author to evolve the following technique for the use of the bone-graft in place of the metal spike.

Illustrative case. Female, 60 years old (Fig. 9). Non-union of neck of the femur of five months' duration. The point of fracture was reached through an anterior incision from the anterior spine of the ilium downward for five inches. The ends of the fragments were freshened by chisel and sharp curette. A point just below the great trochanter was reached by a short lateral incision.

The proper location through the center of the neck and the direction of drill hole for the graft were determined by thrusting a small hand drill through the great trochanter obliquely upward through the center of the neck and into the center of the fractured end of the capital fragment, as felt or seen through the anterior incision. This may necessitate the withdrawal and reinsertion of the drill. When the proper location and direction for the drill hole were determined the large motor-driven drill was pushed inward along the direction previously determined through the center of the neck and well into the head. This drill, made after my directions, produced a hole six-sixteenths of an inch (9.50 mm.) in diameter. The drill was then disengaged from the motor and left in position to hold the fragments in apposition while the bone-graft was being removed from the crest of the opposite tibia.

This graft was removed by the motor saw and was about four inches long by six-sixteenths to seven-sixteenths inch (9.50 to 11.09 mm.) in cross-section. My doweling instrument, which turns out a dowel of proper size to fit the drill hole, was then adjusted into the motor (Fig. 6).

While the motor was held by an assistant I fed the graft slowly into the doweling instrument. This was done with comparative speed and assured a perfect fit. This strong graft was driven into place by a metal mallet. The operative technique was precisely the same as when the metal spike is used. The skin was closed without drainage. In six weeks there was firm union. Six months after operation the patient walked about without pain and with perfect function.

The inlay bone-graft as applied in the seventeen cases of pseudo-arthrosis herein mentioned has given 100 per cent of bony union.

On account of the eburnation which always exists in the ends of fragments in cases of pseudo-arthrosis, it is advisable to use healthy bone from elsewhere in the body, as from the tibia for example.

Fresh fractures. In cases of fresh fractures (Fig. 10), however, the bone being osteogenetic, the graft material can be taken from the fragments themselves and used to advantage. This is best done by making the saw-cuts in one fragment just double the length of the

Fig. 1. The author's modification of the Hartley-Kenyon motor. The right angle arm for saw with gear for reducing speed of saw, and the tube, on the left, for constant spray of saline solution on saw from an elevated douche bag are recent and important improvements. The above-mentioned twin saw is shown in the left upper corner of the illustration; this can be easily and quickly adjusted into motor in place of single saw already there. For technique of its use see text.

other and transposing the two strips of bone. This has been done in two of my later cases of pseudo-arthrosis, and in all cases of recent fresh fractures the inlay graft as well as its gutter site has been so formed that they are about 6.35 mm. wider at their periosteal surface than at their endosteal surface. This wedge-shaped cross-section of graft and its gutter prevents the graft from slipping into the marrow cavity. This is of especial advantage in all operable cases of fresh fracture, because the medullary canal is never filled, as is the case in long standing non-union. The graft is held in place by autogenous dowel grafts placed obliquely into the cortical bone on either side of gutter with their ends projecting over and in contact with the periosteal surface of the graft. This affords a fixation practically as secure as that of the Lane plate and without the use of any foreign substance. The grafts are removed from the fragments by starting the cuts with the twin motor saw adjusted to about seven-sixteenths inch (11.1 mm.) apart in a femur, then completing the cuts through the cortex to the marrow cavity with a single motor saw. The longer strip of bone is then inserted into the gutter so that half of it is in one fragment and half in the other.

Dowels are now turned out with the motor doweling instrument, using for this purpose either the shorter strip of bone or bone removed from the side of the gutter distal from point of fracture.

The graft is then forced into place and four holes drilled obliquely to its side into the cortex of the gutter. The dowels are then driven into place, allowing their ends to project over and in contact with the periosteal surface of graft.

The inlay graft thus inserted affords as secure immediate fixation as the Lane plate.

This as well as other similar technique would be impossible without resorting to the motor saw. The proper use of the motor saw, by shortening the time of operation, lessening the traumatism, and affording a means for accurately shaping the bone-grafts and their beds, has opened up a very wide field of application hitherto impossible of development.

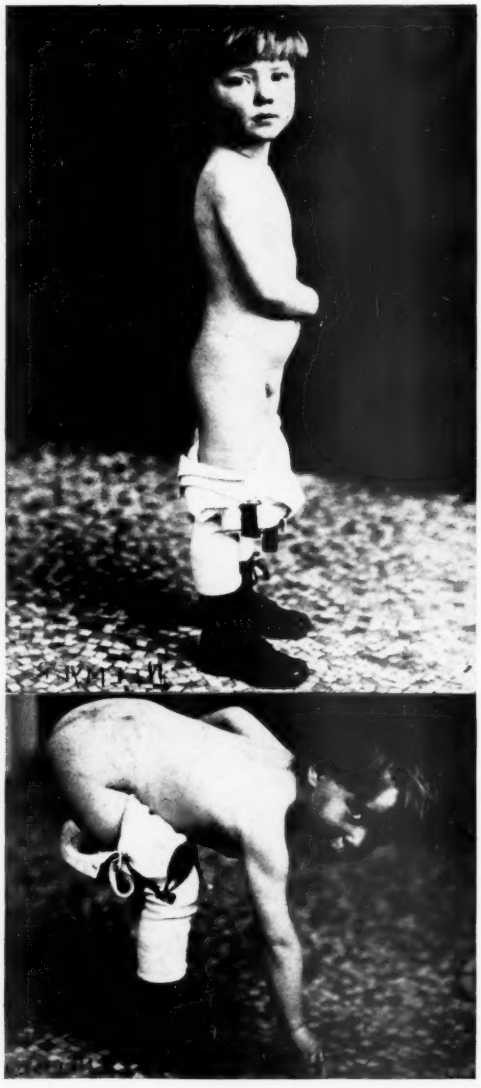


Fig. 2. A very acute case of tuberculosis of lumbar spine, three months after bone-graft was inserted. Child has remained well one year after operation.

There are many technical difficulties in connection with bone work which could never be overcome except by assistance of the motor saw and its various adjustable attachments.

In the repair of deformity and the result of traumatism of the skeleton the advantage of the use of its own material and of the avoidance of the former seemingly necessary foreign substance has been clearly demonstrated.

Fig. 3. Lateral skiagram of dorsal spine with graft bent into and united to the spinous processes. There was a large kyphosis in this case, of long duration and only a small amount of correction. This illustration used here to demonstrate the desired location of the graft in the tips of the spinous processes and the amount it was possible to bend the graft and still hold it by the ligaments drawn over it.

Metal introduced into the tissues is in most respects the direct antithesis of the bone-graft. It favors infection, absorption, and disintegration of tissue.

The bone-graft being living tissue has certain germ-resisting properties. It immediately becomes adherent and fixed to the contacting tissues. It not only stimulates the bone with which it is contacted to increased osteogenesis but it proliferates bone of its own initiative.

ERASION OF THE KNEE-JOINT, WITH BONE TRANSPLANTATION

This procedure is for the treatment of acute adult tuberculosis and the correction of

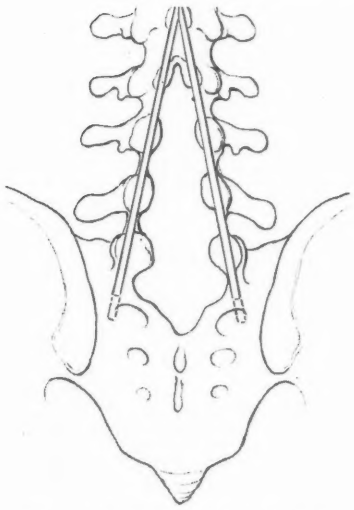


Fig. 4. Diagram showing author's method of straightening or supporting bifid spine (spina bifida) by the insertion of autogenous tibial grafts.

Fig. 5. X-ray taken three months after the insertion of two autogenous tibia grafts for lumbar sacral and sacro-iliac tuberculous ostitis. a, b, is spinal graft inserted into spinous processes of the fourth and fifth lumbar vertebræ and the first two spines of the sacrum. c, d, is the second graft which has been mortised into graft a, b, inserted into posterior wing of the ilium.

It is six months since this child was operated and he has played about with other children without evident symptoms for the past four months, although wearing no external support.

complicating deformities, as fibrous or incomplete bony union.

Before entering the tuberculous joint a graft, eight inches long, is removed from the anterior internal surface of the tibia by the twin saw, adjusted seven-sixteenths of an inch (11.09 mm.) apart, and placed in saline solution until wanted. If the patella is not too much involved it has been used by the writer instead of the tibial graft. By sawing it into inlay grafts it serves the purpose very well.

With an Esmarch bandage about the upper thigh, the knee-joint is reached by a large U-shaped incision, with the lowest point of the curvature over the tubercle of the tibia. The ligamentum patella is divided at its insertion, and the patella is turned upward and removed. The lateral ligaments are cut and the leg flexed on the thigh to the extreme.

The tubercular soft tissue is trimmed away with scissors. With a narrow bow saw a thin section consisting of the cartilage, with the underlying bone (6.35 mm. to 8.46 mm. in thickness) is removed by a saw cut, approximately parallel to the convexity of the condyles of femur. With the same instrument a section about the same thickness is

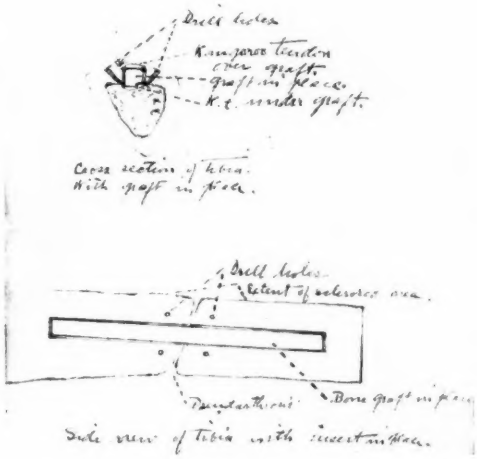


Fig. 6. Cross-section of tibia with graft and sutures in place; also longitudinal surface alignment of fragments with graft implanted.

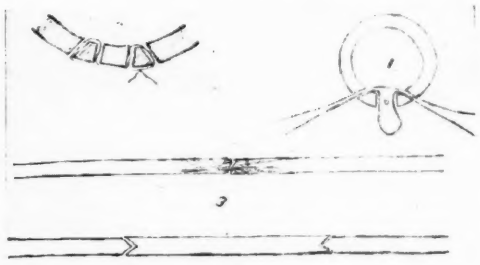


Fig. 7. 1. Illustrates two strands kangaroo tendon passed through drill holes ready for graft to be slipped into gutter with one strand above and the other under the graft. 2. Ends are brought over graft area and tied. 3. Longitudinal section of long bone, illustrating sclerosis at the fracture ends, also graft dovetailed into position.

removed from the head of the tibia by a concave cut, producing a surface which will fit over the convex surface already prepared on the condyles of the femur.

The bone should be so removed that when the cut surfaces are approximated the leg is straight.

The anterior lateral surfaces of the upper end of the tibia and the lower end of the femur are each exposed for about three inches.

The periosseous structures are incised down to the bone, on each side of the patella, on both tibia and femur, parallel with their long axes, and turned sideways with the periosteum elevator.

With the circular motor twin saws adjusted the same as when removing the graft and the tibia, and femur held in good apposition, two parallel cuts are made two inches into each bone at their antero-lateral corners on either side of patella. The strips of bone between the saw-cuts are removed with a small motor burr and narrow chisel.

Holes to receive graft-retaining kangaroo sutures are made in the cortex laterally to the gutter in each bone, or the grafts may be held by autogenous dowel grafts as described in author's technique for ununited fractures. The sutures are inserted by large curved needles or flexible probe, and pulled up from the bottom of the gutter in the form of large loops, under which the graft is placed and pressed into its bed. The sutures are then drawn tightly in place over it and tied. The graft, thus applied, assumes efficient fixation and supplies an active osteogenetic factor and stimulus to the bones into which it is inserted without the use of foreign material, as metal plates, screws, or wire.

The necessity in these cases for some internal fixation has been appreciated in the orthopedic service of the Massachusetts General Hospital, according to Dr. Goddu, since December, 1909, and internal metal plates and clamps have been used in all excisions of knees, and even under these conditions two out of eight cases required re-excisions, on account of inability to form sufficient callus. Goddu mentions twenty-seven cases done in three years, of which four only showed union within six to twelve weeks; four required re-excision, in one case silver wire had to be removed on account of a discharging sinus.

"In three cases where the bones were drilled and held by suture material, in one the suture broke, allowing displacement of the ends of femur and tibia, and a reposition under ether was necessary; in one other there was considerable motion at the end of eight weeks."

On account of similar experience the author has used, instead of the metal plate, the inlay bone-graft, which he believes is far superior.

PARALYTIC AND CONGENITAL DISLOCATION OF THE HIP.—AUTHOR'S ARTHROPLASTY WITH BONE GRAFTING.

In paralytic dislocation of the hip, the rim of the acetabulum is much worn—or, as it seems, absent—when slipping the hip in and out.

The capsule is much relaxed and the muscles about the hip lengthened.

Cases of congenital dislocation of the hip that have been reduced by the bloodless method (Lorenz, Calot) two or more times become somewhat similar to those of paralytic origin, except that the periarticular tissues being properly innervated are, although much stretched, not nearly as lax or flaccid. In some cases the head slips in and out of the acetabulum with as much ease as in the case of the paralytic hip. In most cases, however, a reduction can only be accomplished when

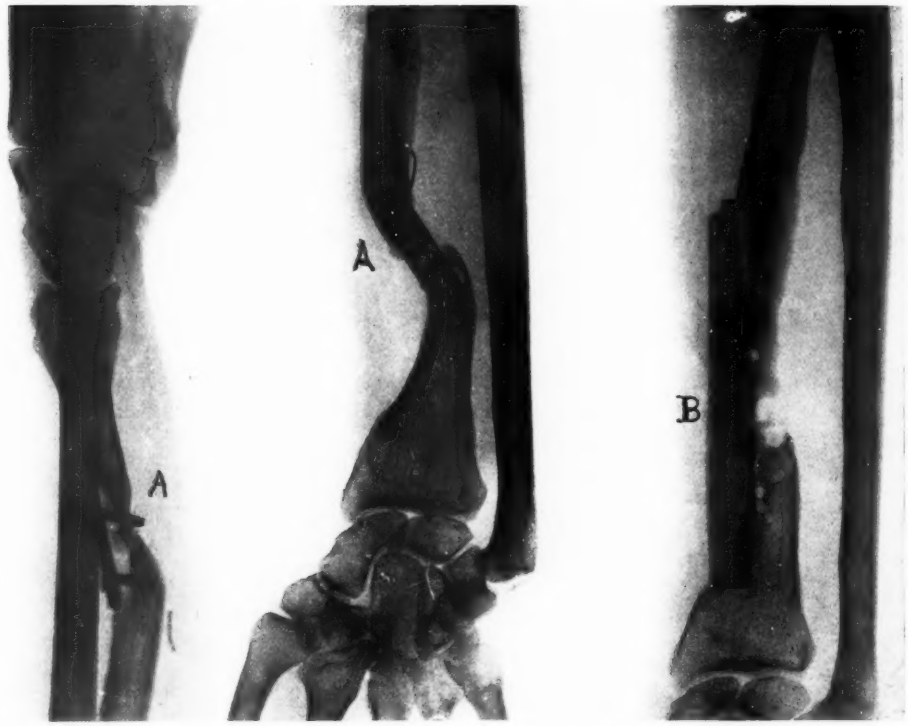


Fig. 8. These are skiagrams of the ununited fractures of the radius described in the text. a, Shows the radius after four years of non-union and four operations and the Lane plate in position two years after its application. Much destruction of bone has resulted with a consequent shortening of the radius. b, Shows the graft in place with firm union of graft to fragments. The ends of the fragments separated and the radius lengthened about 2.50 cm. Firm union and a good functional arm is the result at this writing, five months after insertion of inlay graft.

the child is under an anæsthetic; in either event the hip slips in and out of the acetabulum with evidence of an insufficient acetabular rim.

The first is best obtained by the formation of an efficient acetabular rim and a proper tightening of the relaxed capsular ligament, the second by a minimum interference with joint cartilage. Hoffa's operation, of deepening the acetabulum by the removal of cartilage and bone, has been the one of choice. Its disadvantages, however, are great in that it may result in an immediate marked limitation of motion, and pain. Even good functional joints resulting from this precedure have, years after, become painful and much limited in their motion, undoubtedly largely due to an extensive removal of cartilage and an exposure of a large surface of bone which is prone to proliferate.

The anatomical defects, it seems to the author, are best overcome by the following operation:

AUTHOR'S TECHNIQUE FOR RECURRENT DISLOCATION OF THE HIP

The hip is reached by a lateral incision and the turning up of the upper part of the great trochanter together with the attached muscles (Fig. 11).

The capsule of the superior part of the joint is developed without incising it. With a wide, thin osteotome a broad bone incision about one-half to two-thirds of an inch above, and parallel with the superior edge of the acetabulum, is made obliquely down to the

Fig. 9. X-ray case, female 60 years old; ununited fracture of the neck of femur repaired by dowel graft removed from tibia and shaped to fit drill hole.

Note new bone protruding from outer end of graft. Operation resulted in firm union.

joint cartilage at a point about the same distance internal to the edge of the acetabulum. A sufficient reef is then made with silk sutures in the posterosuperior or overstretched part of the capsule in order to tip down the loosened edge of the acetabulum and thus hold it in that position so as to form an exaggerated acetabular rim. This opens up a wedge-shaped cavity above the acetabular rim by the displacement outward of the bone fragment.

Measures of this cavity are taken with calipers and a wedge bone-graft is procured either from crest of the tibia or the remaining portion of the great trochanter. If it is necessary to shorten the trochanter muscles, the graft is always removed from the base of the trochanter; and when the reflected portion of the trochanter with its attached muscles are replaced, its position is lower by the thickness of the wedge graft removed, thus tightening the muscles to that extent.

The graft is drilled and fixed in place by two sutures of medium kangaroo tendon. The transplant thus fills the wedge cavity above the acetabulum at the same time that it assists the shortened capsule in holding the fragment in its new position.

This procedure preserves all the joint cartilage, is not difficult of execution, and fulfills every anatomical requirement.

THE BONE WEDGE GRAFT IN TREATMENT OF CLUB-FOOT

The severer types of club-foot in children over two and one-half years of age may be considered under two groups, in order to simplify the description and choice of method of treatment. The salient characteristics of the first group are a foot not markedly shortened, but marked adduction of the forefoot, moderate varus, and equinus. The heel is well formed, but much elevated and cannot be brought to the ground. The inner border of the foot is concave and shorter as compared to the outer convex border; the cuboid, if hypertrophied and prominent, is only moderately so. The foot is somewhat smaller than its fellow, due to under-development.

In the severer, or relapsing, cases of this group, when the tarsus resists correction by tenotomies and wrenchings, it is remodeled by placing a bone-graft into the inner short or concave side of the tarsus at the point of its greatest concavity, which is at the scaphoid bone.

AUTHOR'S TECHNIQUE OF THE APPLICATION OF THE BONE

Graft wedge (Fig. 12). In addition to preparing the deformed foot for operation, the leg is also prepared at the same time. A subcutaneous tenotomy of the tendo Achillis is done, and the equinus deformity is corrected. It is important that the heel should be thoroughly brought down, using the foot as a lever over the lower end of the tibia. With the foot on a sand bag, a U-shaped incision is made and a flap of skin and subcutaneous tissue is turned back sufficient to expose the inner aspect of the scaphoid. With a sharp osteotome the scaphoid is split into anterior and posterior halves.

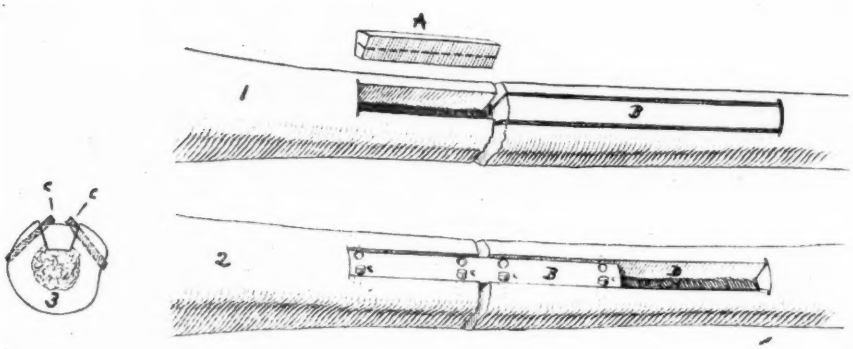


Fig. 10. Diagram illustrating the application of the inlay graft to fresh fractures, preferable to the Lane plate. On account of the absence of any marked pathological change in the fragment ends of fresh fractures, bone material from this source can be used to advantage as can be seen from the cut. In 1′ a and b are removed with motor saw; a is split into two or three long strips of bone which are made round and of proper size (c, c, c), with author's doweling instrument, b is then placed in position as indicated in 2′ and 3′ and firmly held by the dowels (c, c, c). The space in the cortex, d, remains empty.

The correction of the adduction and varus deformities is accomplished by the forced separation and readjustment of the planes of the scaphoidal halves. While an assistant holds the foot in strong over-correction, the distance between the scaphoidal halves is determined by calipers. The wound in the foot is then packed with saline compress. The crest of the tibia of the other leg is now exposed below the tibial tubercle, and a wedge graft is outlined in the periosteum by a scalpel one-eighth to one-fourth of an inch thicker than indicated by the caliper measurement previously taken of the scaphoid cavity. With the small motor saw, cuts are made along the periosteal incision through the bone cor-

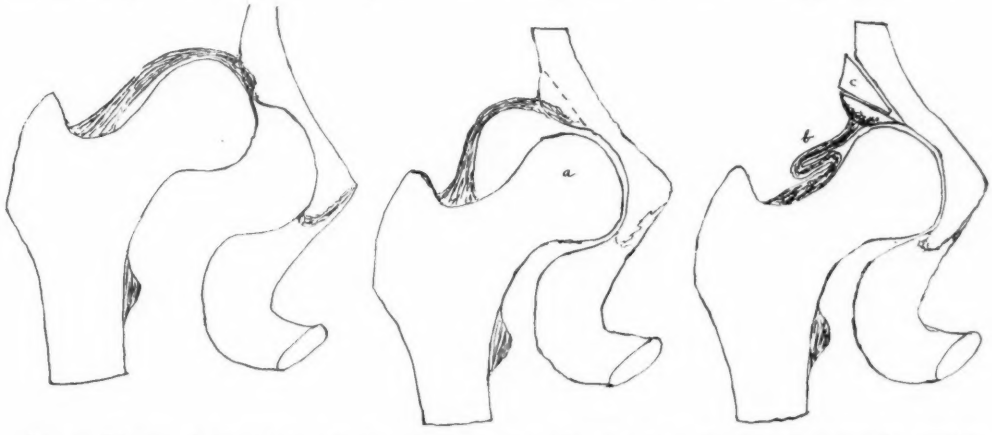


Fig. 11. Diagram of arthroplasty with the application of the bone wedge graft, for paralytic dislocation of the hip and cases of congenital dislocation when the head of the femur will not stay in the acetabulum on account of the shallowness of the acetabulum and the absence of its rim. a, Represents the head of the femur reduced and in the acetabulum. The capsule is shown much overstretched and the acetabular rim absent. The dotted line indicates bone section from just above the insertion of joint capsule down to the top of the joint. b, Shows the capsule reefed with silk sutures and the postero-superior portion of the acetabular edge pulled downward forming a lip, to aid the shortened capsule in holding the head in place. c, Is a wedge shape graft placed in the cavity of the same contour between the cut surfaces of the new acetabular lip and the pelvis.

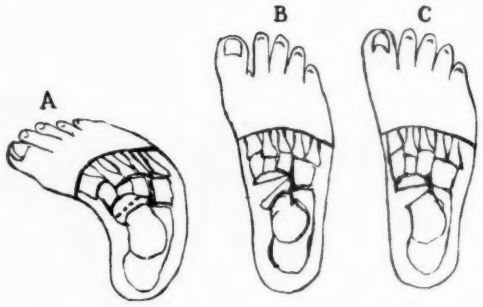


Fig. 12. a, Is diagram showing the element of adduction deformity of a congenital club-foot. The dotted line indicates where the scaphoid is split. c, Shows the foot after osteotomy of the scaphoid and forcible correction of the adduction and varus deformity by the separation of the scaphoidal and a rotation, at that point, of the forefoot on the posterior part of the foot. A wedge, cuboidal, or tibial graft may be used to fill this space, according to the severity of the deformity and hypertrophy of cuboid. b, Indicates the cartilage removed from the posterior surface of the scaphoid and the head of the astragalus in a case of acquired paralytic club-foot (talipes equinovarus) with hypermobility. A correction of the deformity causes a separation of these two cut bone surfaces. The cavity is filled by a wedge tibial graft.

tex. Before disengaging the graft from its bed, drill holes are made in its center with the motor drill. The graft is then removed by wedging a thin narrow osteotome into the saw-cuts, and is threaded on a strand of medium kangaroo tendon, each end of which is threaded into a strong cervix needle.

One needle is forced through the anterior half of the scaphoid from the cut surface side by a strong needle holder, and the other through the posterior half from its cut surface side. In older cases, a drill may have to be substituted for the needle, on account of the density of the bone.

The graft, which is slightly larger than the cavity in the scaphoid, is then forced into position between the two halves of the cut scaphoid, thus closing up the tarsal joints which have been separated anteriorly and posteriorly by the force exerted by the assistant in correcting the foot. The kangaroo tendon suture is then drawn taut over the graft and tied. The periosseous structures are drawn over the graft and sutured with chromic catgut, and the skin wound is sutured with plain catgut.

With the foot over-corrected and the knee flexed to a right angle, a plaster of Paris cast is applied from the toes to the groin. This is allowed to remain on for four weeks, and is followed by a cast from the toes to the knee for an additional four weeks.

In cases presenting a very short foot, more marked varus, and a hypertrophied cuboid, the graft is taken from the posterior part of the cuboid on the outer side of the foot and inserted into the scaphoid by precisely the same technique as that carried out in the tibial wedge graft. These incisions produce a complete transverse section of the bones of the tarsus, and allow the forefoot to be not only swung outward at this point but to be rotated about the cuboscaphoid ligament.

As this ligament lies approximately equidistant from the inner border of the scaphoid and the outer border of the cuboid, it is the center of a circle of which a wedge taken from the cuboid is a sector, and when used to fill the gap formed by splitting the scaphoid and correcting the foot it exactly fits and at the same time the gap formed by its removal from the cuboid is closed.

The foot and limb are fixed to the groin in a plaster of Paris dressing, with the foot well over-corrected and the knee flexed. This dressing should remain on for four weeks, followed by a second plaster of Paris dressing to the knee, to remain on eight weeks.

THE ADVANTAGES OF THE BONE-GRAFT IN CLUB-FOOT

It lengthens the foot, already much shortened. By permanently lengthening the short side of the skeleton of the foot, it insures in a most trustworthy way against a relapse of the deformity. No joint is involved by the operation, therefore it does not cause an interference with joint function or mobility.

Acquired club-foot (*paralytic varus*). This type of deformity is due to unbalancing of the foot by paralysis or weakening of the peroneal muscles. The outer border of the foot drops, the forefoot adducts, and the child walks upon the outer edge of the foot, forcing it into further adduction, and causing an increasing hypermobility at the astragaloscaphoid joint, resulting in a deformity very

Fig. 13.

Fig. 14.

similar to that of a congenital club-foot. The requirements for treatment are very similar to those of congenital club-foot, with the addition, of necessity, of the control of the hypermobility and dropping of the outer border of the foot.

Author's operation for paralytic club-foot (Fig. 13). The tendo Achillis is tenotomized, if shortened. The astragalo-scaphoid joint is reached by a U-shaped incision and turning up of a flap of skin and subcutaneous tissues. With a sharp chisel or osteotome all the cartilage is removed from the posterior surface of the scaphoid and the head of the astragalus. The foot is over-corrected and the antero-posterior diameter of the cavity is taken between the cut bone surfaces of the scaphoid and astragalus. The wound is packed with hot saline compress. The tibia is laid bare about three inches below the tubercle of the tibia. The dimensions of the required graft are outlined by a scalpel in the periosteum. With the small motor saw cuts are made completely through the bone cortex. With the motor drill two holes are drilled through the cortex of the graft, before it is disengaged from the tibia. The transplant is then removed from its bed with a chisel and threaded upon one or two strands of kangaroo tendon, the ends of which are threaded into strong cervix needles; one needle is forced through the inner border of the scaphoid from the cut surface side, and the other is passed through the inner surface of the head of the astragalus from the cut surface side. The graft is pushed into position between the astragalus and the scaphoid, the sutures drawn tight and tied over the graft. The periosseous tissues are drawn over the graft and sutured with chromic catgut and the skin wound is closed by continuous plain catgut suture.

If the peroneal muscles are entirely paralyzed, the varus or dropping of the outer side of the foot can best be controlled by using the tendons of those paralyzed muscles for ligaments.

The peroneal tendons and external malleolus are exposed by a curved incision with its convexity posterior. An osteo-periosteal flap, one inch in its vertical diameter and two-thirds of an inch in its antero-posterior diameter, is turned posteriorly by a chisel on the periosseous and periosteal tissues as a hinge. The peroneal tendon sheaths are split for a considerable distance up and down from opposite the periosteal flap, and the tendons are brought forward and placed beneath the osteo-periosteal flap, which is sutured over them with silk. Additional silk sutures are passed through the upper and lower edges of the osseous flap, through the tendons, and into the periosteum and periosseous tissues of the fibula beneath the tendon.

It is important that the foot is held over-corrected and that the tendons are held taut while the sutures are placed in position (Fig. 14). The skin wound is closed by continuous

catgut sutures. With the foot held in over-correction, and the knee flexed, a plaster cast is applied from the toes to the groin. This plaster should be removed at the end of four weeks and be replaced by another reaching from the toes to the knee for an additional six weeks. It should be determined in individual cases whether support by braces is needed.

If it is not desirable to use the peroneal tendons for ligaments because the muscle power is not entirely lost, silk ligaments may be inserted between the tip of the external malleolus and the cuboid, to fortify the weakened muscles. This is best accomplished by short incisions over the external malleolus and cuboid, and the silk ligaments passed under the skin by tunneling with a blunt-eyed probe or a broad ligament clamp. The ends are inserted into the bones of the external malleolus and cuboid by strong cervix needles or by drilling. As there is danger of the untying of knots of heavy silk, fine silk is tied around each half knot.

Post-operative convalescence is carried out in precisely the same manner as when the tendons are used for ligaments.

Advantages of the above method. Adduction and varus are corrected. The adduction is overcome by lengthening the inside of the foot and fixing the scaphoid opposite at anterior surface by the mechanics of a wedge.

Hypermobility is controlled and a stable foot is produced. The mechanical balance of the foot is much improved. The anterior tibial muscle, an active factor in producing the deformity, is restored to its normal function. In certain cases when the anterior tibial is well developed and the peroneal muscles are paralyzed, the adduction of the foot is over-corrected by inserting a large wedge graft; the anterior muscle is thus made to do more than its normal work by overbalancing the foot.

CONCLUSIONS

1. My experience as to the trustworthiness of the bone-graft, as surgical agent, when taken with its enveloping membranes (periosteum and endosteum) and contacted with bone, has been borne out by Murphy, McWilliams and others, who have obtained practically 100 per cent of successes. In my last one hundred cases the successes have been 100 per cent.

2. The endosteum, marrow substance, and periosteum should be included on the graft, as they play a most important rôle in aiding to establish an early and sufficient blood supply from the recipient tissues to the cortical part of the graft. The endosteum is also actively osteogenetic as well as the inner layer of the true periosteum.

3. A rapid and complete union between graft and recipient bone should be in many cases enhanced by the interposition of numerous small grafts in which the periosteum may be disregarded because of the easy access of blood supply to their interior osteoblasts. These coalesce with each other and also with the recipient bones and the large graft.

4. The living bone-graft has certain bacteria-resisting properties, as evidenced by two of my animal experimental cases where sepsis occurred and parts of each graft became united to the recipient bones, while the rest of the transplant succumbed to the infection and requestrated.

5. The bone-graft apparently acts always as a stimulus to osteogenesis to the bone into which it is ingrafted or contacted.

6. The bone-graft when well contacted becomes immediately adherent to the recipient bone by newly formed tissue, which changes to solid bone within four weeks' time. This together with its bacteria-resisting property strongly favors, in the author's opinion, the substitution when feasible of the bone-graft in place of all metal internal splints, especially when it is appreciated that metal has the opposite effect to the graft, in that it inhibits callus formation, produces bone absorption, and favors infection.

7. The dowel, the inlay and wedge bone-graft afford a means of repairing and remodeling the skeleton which the surgeon has not hitherto possessed.

COMPOSITE OR FIBRO–EPITHELIAL TUMORS OF THE LIPS

By WALTON MARTIN, M. D., New York City

THE following case seems sufficiently unusual to make it of interest:

A boy, fifteen years old, had noticed two years previously, a small mass, about the size of a pea, in his lower lip. This mass had gradually increased, so that the lip was pushed forward. There had been no pain or discomfort; he wished simply to be relieved of the deformity. The boy had always been in good health. He had no similar swellings. The teeth and mouth were normal. His family history was negative.

Examination. On examination there was found embedded in the substance of the lip near the middle line, an oval swelling with the long axis of the oval in the sagittal plane of the body about one-half inch in length and one-quarter inch in width. It was tense, firm, and freely movable. The skin was tightly stretched over the little mass, and the mucosa of the mouth to a less extent. It was not tender and there was no heat or redness in the surrounding areas. The portion of the tumor presenting under the skin looked whitish.

Operation. Through a small linear skin incision, under cocaine anæsthesia, the small tumor mass was readily enucleated by blunt dissection.

Specimen. The specimen removed was an elongated tumor three-eighths inch by five-eighths inch, slightly constricted in the middle. It was obviously made up of two parts, one mainly cystic, the other solid. On section these two parts became even more evident. The solid portion was firm and suggested the appearance presented by the so-called mixed tumors of the parotid.

Microscopical examination. Under the microscope the tumor was seen to be enclosed in a fibrous capsule. From this capsule a strong band passed inward, dividing the tumor into two parts and giving it the appearance of being constricted in the middle, as seen macroscopically. Derived from the connective-tissue capsule and this main connective-tissue partition, secondary septa passed into its substance. In places this connective tissue changed gradually into a more cellular, mucoid tissue. The connective-tissue framework and the mucoid tissue were moderately vascular and together made up about one-eighth of the tumor. The rest was made up of cysts of various sizes lined with columnar, cuboidal and somewhat flattened epithelial cells, with deeply stained nuclei, arranged in layers, and of solid masses, bands, bars or strands of epithelium, lying in the basement membrane. The microscopic appearance again is similar to the so-called endotheliomata or mixed tumors of the parotid.

Scattered through the medical records are reports of similar labial tumors. One was described by Sir William Lawrence in 1831. It was the size of an English walnut and contained not only cartilage, but also a small portion of bone.

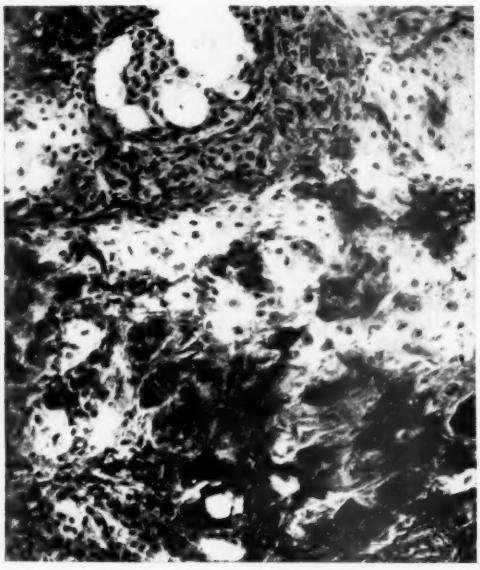
In his lectures on surgical pathology, Sir James Paget referred to two specimens he had had an opportunity of examining. In neither specimen was cartilage found.

Broca, in Duplay's Surgery, in his article on labial tumors gives a good description of these new-growths under the heading of mixed tumors of the labial glands. He refers to the reports of ten cases.

Ribbert in his Geschwülstlehre (1904) under the heading of composite tumors of the salivary glands, describes a similar tumor that he had examined, taken from the upper lip. In the *Précis de Pathologie Chirurgicale*, under the heading of tumors of the lips of salivary origin, an account is given of these neoplasms.

Beneath the mucosa of the lip, interposed between it and the orbicularis oris, is a layer made up of glands. These glands are embedded in the submucous connective tissue and are surrounded by fat. They are acinous glands provided with excretory ducts which open on the surface of the mucous membrane in the oral cavity. Recent investigation has shown that they belong apparently to the so-called mixed type of salivary glands, like the submaxillary and sublingual.

New-growths arise in these labial glands just as similar tumors arise in one of the other salivary glands. Clinically they are benign. The disfigurement that they cause insures their early removal, possibly before they have an opportunity of undergoing



A. 300 X. Connective-tissue stroma showing cartilage elements, in upper left-hand corner. Cells undergoing mucin-like degeneration.

D. 300 X. Demonstrating capsule, stroma and numerous epithelial alveoli.

malignant change. For it is well known that similar growths in the parotid, after many years of slow growth, may show signs of great malignancy and rapid growth. They are uncommon, and almost all of the reported cases are of the upper lip. The situation of the growth in the lower lip, described above, is very unusual.

E. 20 X. View of a slice from entire tumor; showing capsule and relative proportion of cystic to solid tissue. A. and D. show portion cut out for photomicrographs.
(From the Laboratory of Surgical Pathology, College of Physicians and Surgeons, Columbia University, N. Y.)

Without entering into a discussion of the correct classification of this interesting group of tumors (made up of epithelial cells, cartilage, bone and connective tissue), I will simply present Ribbert's views. He explains in a footnote that the heading "Composite Tumors" (Zusammengesetzte Tumoren) was a misprint; that these growths are really fibro-epithelial tumors. He groups them with fibro-adenomata of the breast. He believes that the changes into cartilage, mucoid tissue and bone are all forms of connective-tissue metaplasia and that, if the tumors are carefully enough examined, transitional places will be found where the connective tissue passes gradually into mucoid tissue and this into cartilage and bone. He divides them sharply from *true* mixed, or as he prefers to call them composite tumors, such as are found in the mouth and the sacrococcygeal regions, epignathii, teratomata, etc. He believes that the cellular masses are epithelial, not endothelial (a view held by Volkmann).

The sections of this little tumor are very interesting in reference to this point of view.

AN IMPROVED GILLIAM OPERATION FOR UTERINE DISPLACEMENTS[1]

WM. CUTHBERTSON M. D., CHICAGO

DISPLACEMENTS of the uterus may be divided into anterior and posterior displacements and descent. The anterior and posterior displacements may be subdivided into flexions and versions, and descent into the first, second, and third degrees. The operation which I am about to describe is applicable to the retrodisplacements and the first and second degrees of descent.

The normal uterus is maintained in its normal position in the pelvis by the pelvic fascia and the connective tissue surrounding the blood-vessels of the organ. As it appears in the normal state when the abdomen is opened, it is pale pink in color, of a moderately firm consistency on palpation, and lies in moderately anteflexed position with its fundus pointing forward and upward, towards the symphysis pubis. None of its ligaments, the round, the broad, nor the uterosacral, are on the stretch. It is freely movable, laterally, anteriorly, posteriorly, and upwards and downwards. After these various movements it assumes its normal position automatically.

Etiology. To produce any of the different displacements of the uterus, often the first thing to occur is interference with its circulation, accompanied or not by traumatism or infection, which results in an increase in its size and weight. This circulatory disturbance may be caused by, first, pregnancy; second, infection; third, congestion;— the first two frequently being accompanied by traumatism.

1. When normal pregnancy occurs followed by a natural delivery without any infection and a proper puerperium being maintained, the uterus undergoes involution and it resumes its normal position in the pelvic cavity. When, however, infection occurs, or the uterus is badly traumatized during delivery, subinvolution follows which, of course, alters the size and weight of the uterus.

2. When from any of the numerous causes, infection of the non-pregnant uterus takes place, the natural phenomena of inflammation ensue, and again the size and weight of the organ are materially increased, and its position in many instances abnormally altered. This deranged position may be brought about either through the increased weight alone, due to circulatory disturbance, or by adhesions having formed, which draw and fix the organ in its displacement, or by both combined.

3. In many virgins we have displacements of the uterus of all varieties. W. J. Mayo (1) states: "We have complete records of the physical examination of many thousands of women. While the normal position of the uterus in the majority of women, perhaps 75 per cent, is more nearly anterior than posterior, it must be acknowledged that in at least 25 per cent and at various ages retroposition exists. The condition will be found as often in the young girl as during the child-bearing period, and after the menopause, and it is probable that retroposition of the uterus is even more common than these data would suggest." The anterior and especially the retrodisplacement may be brought about in the following manner: At the menstrual period the young woman may be subjected to extreme cold, a severe wetting, or a fright, which may produce a cessation of menstruation when the uterine blood-vessels are full and turgid. This results, as in the causes mentioned before, in an increase in the size and weight of the organ and the local conditions are ripe for a displacement. Owing to the increased size and weight produced by the foregoing causes, one of two things happens. When displacement occurs either the fundus falls forward, producing an increased ante-flexion, or the uterus straightens up owing to the increase in blood pressure, and the vertical axis of the uterus lies in the same plane as the vertical axis of the pelvis, where it is in position to begin descent. Now, if the pelvic fascia and the uterine ligaments are normal, the uterus may undergo involution, and spontaneous recovery ensue. On

[1] Read before the Chicago Gynecological Society, January 16, 1914. (See discussion, p. 778.)

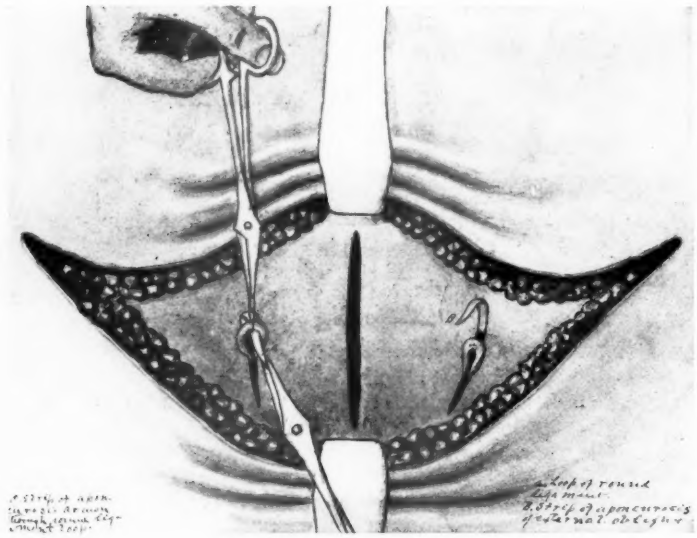


Fig. 1.

the other hand, with relaxed ligaments and fascia, any sudden increase in voluntary muscular effort, or increased intra-abdominal pressure, may push the uterus over into retroversion, or the first step of descent is begun.

Prolapse of the uterus is merely a hernia, and is produced by the same influences which cause herniæ in other parts of the body; viz., relaxed outlets, increased internal pressure, and traumatism.

In addition, Barton Cooke Hirst (2) says: "There are three injuries responsible for prolapse which must be kept in mind. First, the stretching with possible actual lacerations of the fibers of the cardinal ligaments of the uterus in the bases of the broad ligaments supporting the cervix, lower uterine segment, and, indirectly, the vaginal vault. Second, the complex injury of the anterior vaginal wall, consisting in (a) an over-stretching of the longitudinal fibers of the fascial plate derived from the bases of the broad ligaments, extending downward between the bladder and the vagina; (b) a lateral separation of these fibers by the eccentric pressure of the child's head in labor; (c) a glacier-like movement of the vaginal wall on its subjacent attachments, tearing them loose; and (d) a laceration of the muscle and fascia of the urogenital trigonum, the only support of the lower third of the anterior vaginal wall. Third, a laceration of the levator ani muscle in the posterior vaginal sulci with a certain amount of that glacier-like movement of the posterior vaginal wall noted in the anterior wall."

Symptomatology. The reasons which cause a woman suffering from displacements of the uterus to consult her physician are many and varied. In marked prolapse the cause is obvious, yet it is astonishing how many women refrain from any consultation even when suffering from a marked degree of prolapse, because they are suffering no pain, but merely are inconvenienced by the uterine protrusion, and the soiling of their linen from discharges of pus and blood—the fear of an operation evidently being paramount. In a larger number of instances, however, the patient complains of a bearing-down pain, and, where the displacement is accompanied by a severe perineal laceration, of a feeling as if "everything were falling out of her."

Pain in the sacral region is prominent; constipation is often a marked symptom, combined with painful defecation; there is not

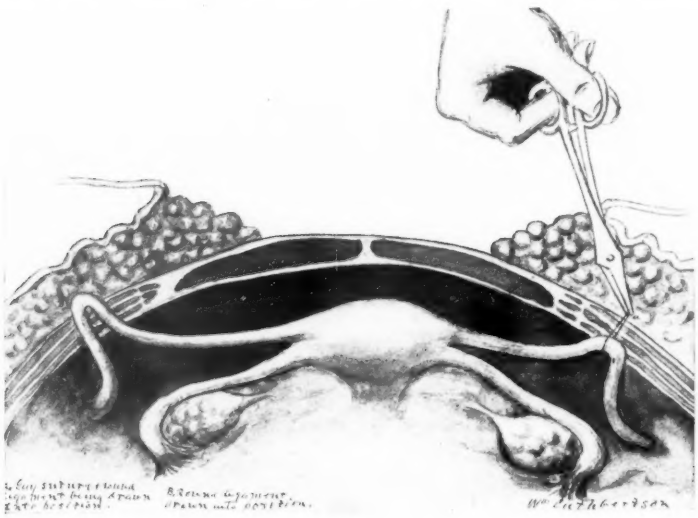


Fig. 2.

infrequently a dysmenorrhœa; amenorrhœa and menorrhagia and metrorrhagia may alternate; while finally, after more or less prolongation of any or all of the above symptoms, a state of neurasthænia may have supervened. On the other hand, there are undoubtedly many cases of uterine displacements of pronounced type (excluding, of course, prolapse) which produce no symptoms whatever. The presence or absence of these symptoms may be explained by Crile's mechanistic theory of disease. In those women who have been subjected to oft-repeated child-bearing, abortion, or who have indulged in excessive coitus, there is produced what Crile terms a "lowered threshold" by repeated stimuli to the afferent nerve tracts; while in virgins, masturbation and unsatisfied sexual longings excite the nerve tracts in a similar manner and the same results obtain. This "lowered threshold" brings the sexual organs of the patient into undue prominence, and hence any unusual disturbance draws her attention to the pathologic condition of the parts and she seeks relief.

Operation. I will not attempt to enumerate all the various operations which have been devised for the correction of the uterine displacements, but merely draw attention to some of the more prominent ones. The Alexander operation was one of the most widely used in the correction of these displacements, but it was applicable only to those cases which were free from adhesions and infections and where the uterus could be easily drawn forward. This operation when properly performed was one of the most successful which has been devised and could be utilized either during the child-bearing period or after the menopause.

Next came the ventrofixation and ventrosuspension operations. These were absolutely bad, the first because it fixed the uterus in an abnormal position and could not be used during the child-bearing period on account of its being a prolific cause of abortion, as well as being responsible for many cæsarean sections from the dystocia which it produced. Ventrosuspension was less objectionable as it could be performed at any period of the woman's age. Its defects were, however, that where only one attachment was made to the anterior abdominal wall, the resulting cord was not sufficiently strong to hold the uterus in position, and an elongation took place which allowed the uterus to fall back into its old condition of retroversion or descent. If two attachments were made,

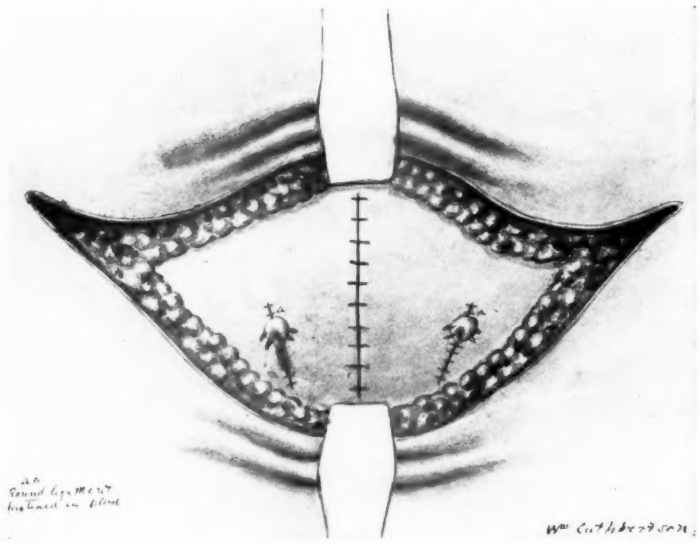


Fig. 3.

intestinal obstruction and strangulation took place in a sufficient number of cases to condemn the operation.

To my mind, any operations which involve the use of the broad ligaments, such as plicating, stitching them to the posterior surface of the uterus, etc., are wrong in mechanical principle, consequently they will not be mentioned. From the number of operations in which it has been utilized, it would seem that the round ligament is the most useful structure by which these displacements can be corrected. Furthermore, the mechanical principle which is involved in its utilization, viz., an upward and forward pull, seems to be the most correct. That upward and forward pull is the greatest when the round ligaments are brought out through the anterior abdominal wall, rather than where they are fixed through vaginal incision, such as in the Watkins-Wertheim operation. One of the earliest and most cogent objections to the anterior abdominal wall operation was that the round ligaments could not be permanently secured in the recti muscles and the fascia. To overcome this the late Alexander Hugh Ferguson and Franklin H. Martin brought the round ligaments across the front of the abdomen either over the aponeurosis or through a tunnel and stitched them together. This pulled the uterus up too close to the anterior wall and also put too great a strain on the ligaments, especially if they were short and poorly developed, and even after this stitching they did not hold in their new position.

H. N. Vineburg (3) fastens the uterus to the anterior wall by two sutures placed around the round ligaments on either side of the uterus which are brought out through the recti muscles and fascia and tied subcutaneously. He claims good results from this operation, although he reports one case of intestinal obstruction following its use. Gilliam's operation (4) in which he brings the round ligaments out through the anterior abdominal wall at the internal ring seems to me to be the nearest to anatomical perfection, in that it produces the least disturbance in position of the round ligaments, leaves no openings for the production of intestinal obstruction, and produces the greatest degree of correct mechanical pull, viz., upwards and forwards, which is necessary to overcome the displacement under consideration. The weak point in his operation, however, is the tran-

sient holding in place of the shortened ligaments, and it is this defect which I have endeavored to overcome and which I have the honor to submit for your favorable consideration.

Operation. The first step after the usual preparation of the patient is to make a Pfannenstiel incision from one internal ring to the other, and after loosening the skin upwards and downwards from the subjacent fascia the abdomen is opened in the median line by as small an incision as possible through which necessary manipulations can be made (Fig. 1). All uterine adhesions are broken up, the resulting bare spots are covered over by peritoneum, the uterus replaced in normal position, and the round ligaments on either side caught up by rubber-protected intestinal forceps. This procedure I find necessary because the round ligaments can be easily amputated by bare steel forceps. After the round ligaments are isolated, a point is selected far enough from the uterus which when the ligament is shortened will hold the uterus in its normal position. In selecting this point the size of the ligaments will have to be taken into consideration—the smaller the ligament, the nearer the uterus is the point to be selected. Through this point a catgut guy suture is passed and the round ligaments drawn through the anterior abdominal wall as in the Gilliam operation (Fig. 2). The next step is adapted from the operation of L. L. McArthur where he uses a live aponeurotic suture in the radical cure of hernia.

The aponeurosis of the external oblique is seized with a snub-nosed forceps and with a scalpel, a strip of the aponeurosis is peeled up from just above Poupart's ligament to a point about two cm. above where the round ligament emerges from the muscle. Next, a sharp-pointed pair of Kocher's forceps is pushed through between the two arms of the ligament and, catching the aponeurotic strip, it is drawn down into place again and stitched there with a continuous catgut suture (Fig. 3). Interrupted catgut sutures are placed through the round ligament and fascia to hold the ligament in its new position until the strip of aponeurosis shall have grown into place. By this means the round ligament is permanently prevented from slipping or being pulled back into the abdominal cavity, and the uterus is absolutely held in its normal position.

I have performed this operation fifteen times in the past two years. Twelve of the patients are still under observation in which no recurrence of the displacement has taken place. The other three have been lost sight of. Two of these women have undergone pregnancy and delivery. There was no dystocia in either case. Three of the women had prolapse of the uterus of the second degree, with torn perineum, and three, associated rectocele and cystocele. In these patients plastic operations were done on the vagina.

I have found this operation to be exceedingly valuable in case of a cystocele accompanied by uterine prolapse. After an anterior colporrhaphy is done and the uterus is well drawn up and fixed, the cystocele does not recur.

In my earlier operations I found that where the genito-crural or ilio-inguinal nerves were caught in the suturing, a good deal of pain persisted in the inguinal region. Subsequently I have been careful to avoid these nerves, with the happiest results.

By using the Pfannenstiel incision through the skin and the vertical through the subjacent abdominal wall plenty of room is assured to perform any necessary operations on the uterine adnexa which may be found imperative.

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THE EDUCATIONAL VALUE OF CANCER STATISTICS TO INSURANCE COMPANIES, THE PUBLIC, AND THE MEDICAL PROFESSION[1]

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CANCER, in its relation to life insurance, presents itself in a threefold aspect: first, as a problem in selection or insurance medicine; second, as an element in insurance experience; and third, as a question of state medicine, with a special regard to the educational value of cancer statistics and the feasibility of cancer control. The importance of the problem is set forth in the statement that the approximate mortality from cancer in the continental United States for 1913 is about 75,000; and considered by organs or parts affected, the estimated mortality for 1912 was as follows:

ESTIMATED MORTALITY FROM CANCER IN THE CONTINENTAL UNITED STATES, 1912

	Both Sexes. Deaths.	Per Cent.
Buccal cavity	2,768	3.9
Stomach and liver	28,041	39.5
Peritoneum, intestines, rectum	9,371	13.2
Female organs of generation	10,790	15.2
Breast	6,886	9.7
Skin	2,627	3.7
Other organs and parts	10,507	14.8
	70,990	100.0

For the year 1910 the average age at death in cancer and other malignant tumors combined was 59.2 years for the registration area of the United States. For males the average age at death was 60.4 years, and for females, 58.4 years. Considered by organs or parts affected, the average age at death in cancer of the buccal cavity was 63.1 years; in cancer of the stomach and liver, 61.2 years; in cancer of the peritoneum, intestines, and rectum, 59.2 years; in cancer of the female generative organs, 53.8 years; in cancer of the breast, 58.3 years; in cancer of the skin, 68.0 years; and in cancer of other organs and parts not specified, 56.9 years.

As a problem in insurance medicine, cancer presents unusual difficulties to both the examining physician and the medical director. The literature of the subject extends over half a century, since practically every authority on insurance medicine has given the subject at least incidental consideration. Most of the earlier writers, beginning with Brinton in 1856, emphasize the assumed hereditary character of cancerous affections, but as early as 1857 Ward called attention to the personal aspects of the disease as made evident in "sallowness or pallor of the face, the general clayey hue of the skin, and peculiar sadness of expression." Also, "the anæmic, chlorotic aspect of females suffering from uterine deragement." Allen, who was apparently one of the first American writers on insurance medicine, in his "Medical Examinations for Life Insurance," published in 1866, referred briefly to the subject under the general title of tumors, giving a few directions of value in medical examinations and advising unconditional rejection even in the case of non-malignant tumors as involving danger by their anatomical position or as requiring a severe surgical operation.

These views have continued to prevail among writers on cancer as a problem in medical selection for insurance, and passing over a large number of authors whose conclusions I have been at pains to bring together, I would refer first to the standard treatise by Charles Lyman Greene on "Medical Examination for Life Insurance," published in 1905, in which occurs the statement that "the hereditary nature of cancer is a subject of dispute, but the weight of evidence is strongly in favor of a well-marked hereditary influence." Havilland Hall, in 1906, in the third edition of his "Medical Examination for Life Assurance," writes that "cancer comes next to consumption in regard to frequency of hereditary transmission." Ramsey, in 1908, in his "Practical Life Insurance Examinations," accepts the hereditary theory of cancer occurrence; and Brockbank, in 1908 also, in his work on "Life Insurance

[1] Read before the Clinical Congress of Surgeons of North America, Chicago, November 13, 1913.

and General Practice," concludes that "females show a greater tendency to inherit whatever is the condition which leads to cancer than males do, and they also die from it at a younger age than their brothers would." In a general way, continental authorities have accepted the same view, and their conclusions are apparently sustained by the experience of the Gotha Life Insurance Company, but for a comparatively early period of time.

Few of the writers on insurance medicine have given useful advice on methods of diagnosis to disclose either an existing cancerous condition or a well-pronounced tendency to the disease. The over-emphasis given to the assumed hereditary theory has no doubt been of much harm in that it has prevented a due consideration of the non-hereditary aspects of the disease when considered from a life insurance point of view. It is also quite probable that most of the writers have taken for granted a general conformity on the part of the examining physician to accept and act upon the prevailing theories in medical diagnosis, direct and differential, which, it goes without saying, has made considerable progress during recent years. This conclusion applies not only to cancers in general but particularly to gastric ulcers and their complications, to cancer of the stomach, and, in the case of women, to cancer of the breast. The cancer experience of life insurance companies cannot be fully reviewed on this occasion. The published data are of considerable scientific interest and well deserving of a qualified and thorough analysis. They date back over more than a century and illustrate the advance of medical science as much as they sustain the conclusion that there has been an actual increase in the cancer death rate.

A large amount of statistical information on the subject of cancer is available for American and foreign insurance companies, but the available data can only be very briefly referred to. The experience of the Germania, of Stettin, published in 1897, sustains the Gotha experience as regards the value of medical selection in reducing the mortality from cancer during the earlier years of insurance. Considering the two periods of a duration of five years or less, and six years or more, it appears that the actual mortality of males per 1,000 at ages 31–40 was 0.21 and 0.32, respectively; at ages 41–50 it was 0.67 and 1.14; at ages 51–60 it was 1.97 and 2.87; and at ages 61 and over it was 4.63 and 6.64. The results for females are about the same. The cancer death rate for males was 1.33 per 1,000; and for females, 1.90. The experience covers the period 1857–94. It may be stated in this connection that for women only the death rate from cancer during the period 1857–82 was 1.38 per 1,000, whereas for the entire period, 1857–94, it was 1.90. There had, therefore, been a not inconsiderable increase in the cancer mortality during the later years, but to be entirely conclusive, the experience should have been extended to insurance durations and divisional periods of life.

In the experience of the Austrian Phœnix, the proportionate mortality from cancer has increased from 8.5 per cent during the five years ending with 1906, to 10.4 per cent during the five years ending with 1912. In the experience of the Riunione Adriatica di Sicurta, of Triest, the proportionate mortality from cancer has increased from 9.3 per cent during the seven years ending with 1905 to 8.0 per cent during the seven years ending with 1912. In the experience of the Leipziger, which is one of the largest German life insurance companies, the percentage of deaths from cancer has increased from 11.8 during the ten years ending with 1902, to 12.6 per cent during the ten years ending with 1912. In the experience of a large Hungarian company, however,— the Fonciére,— the proportionate mortality from cancer has slowly declined from 8.6 per cent during the five years ending with 1905, to 8.0 per cent during the five years ending with 1911. In the experience of the Assicurazioni Generali, the largest Austrian company, the proportionate mortality from cancer was 9.2 per cent during 1899–1905, against 9.5 per cent during 1906–12. The experience of many other foreign companies could have been quoted to sustain the conclusion that in most cases the proportionate mortality from cancer has increased

during recent years, and that in any event the mortality from malignant disease is of more importance to life insurance companies than has generally been assumed to be the case.

The most recent American investigations tend to confirm this point of view. In 1903, the combined experience of thirty-four American life insurance companies was published by the Actuarial Society of America. It was brought out with reference to persons who had a family history of cancer that the subsequent experience had been very good with young entrants, almost equally good with mature entrants, fairly good with elderly entrants, but not good with old entrants, but the actual number of the latter was hardly sufficient for a final adverse conclusion.

The most recent investigation is for the period 1885–1908. The number of deaths of males at ages 15–29 was 4,566, of which 95 were from cancer and other malignant tumors, or 2.1 per cent. The mortality rate was 1.0 per 10,000 at ages 30–44; the total number of deaths was 7,886, of which 377 were from cancer, or 4.8 per cent of the mortality from all causes, or 3.2 per 10,000 exposed to risk. At ages 45 and over there were 5,340 deaths, of which 411 were from cancer, or 7.7 per cent of the mortality from all causes, or 14.4 per 10,000 exposed to risk.

The same experience has been made up regarding women applicants. At ages 15–29 the number of deaths from all causes among insured women was 3,696, of which 98, or 2.7 per cent, were deaths from cancer, or 1.4 per 10,000 exposed to risk. At ages 30–44 there were 5,661 deaths from all causes, of which 668, or 11.8 per cent, were deaths from cancer, equivalent to a rate of 7.3 per 10,000 exposed to risk. At ages 45 and over there were 4,917 deaths from all causes, of which 654, or 13.3 per cent were deaths from cancer, or 24.3 per 10,000 exposed to risk.

The medico-actuarial investigation considered also the relation of build at entry to causes of death, with distinction of three divisional periods of life. Dividing the applicants into three classes,— that is, overweights, or those whose weight at entry was 50 lbs. and more; and standard lives, or those who were of normal weight; and underweights who weighed 25 lbs. or more below the standard,— the experience with reference to cancer was as follows: at ages 15–29 the cancer death rate of overweights was 0.9 per 10,000, and of underweights, 0.8. At ages 30–44 the cancer mortality of overweights was 3.7 per 10,000, and of underweights, 2.4. At ages 45 and over the cancer mortality of overweights was 15.6, and of underweights 12.0 per 10,000 exposed to risk. The experience, therefore, conclusively sustains the view occasionally expressed by writers on the subject of cancer occurrence, that the disease is more common among persons of overweight than among underweights, and, by inference, among the well-to-do and over-nourished, than among the less prosperous element but of more normal physique. The medico-acturial evidence is of exceptional value in that it confirms this conclusion for three periods of life on the basis of what may safely be considered to have been a sufficient exposure.

Some very interesting facts regarding cancer as disclosed by the experience of a large and representative life insurance company were first exhibited by The Prudential Insurance Company of America in connection with an exhibit made at the Louisiana Purchase Exposition in 1904. The information has been brought down to date for the present purpose, and the results seem to sustain the conclusion that the proportionate mortality from cancer is distinctly less among industrial risks, representative of the wage-earning element, and distinctly higher among ordinary risks, regardless of a more rigid medical examination, but representative of the more prosperous and well-to-do. Considering only the age period 40–59, it appears that for males the proportionate mortality from cancer in the company's ordinary experience was 6.7 per cent against 5.10 per cent in the industrial experience. For females, the corresponding proportions were 18.5 per cent in the ordinary experience, and 13.7 per cent in the industrial. Throughout, the proportionate mortality from cancer was very much higher among insured women than among insured men. Selecting, for illustration, the age period 50–54, it appears that in the industrial experience of The Prudential

the proportion of deaths from cancer at this period of life was 5.76 per cent for males, against 15.31 per cent for females. In the ordinary experience the corresponding proportions were 8.1 per cent for males and 18.3 per cent for females. It is quite probable that the value of medical selection, with particular reference to cancer, is distinctly less in the case of insured women than of insured men; but in view of the facts disclosed by the medico-actuarial investigation, that there is a distinct value in the medical selection with reference to cancer as shown by the reduced mortality from this disease during the early years of policy duration, it would seem entirely safe to conclude that the proportionate mortality from cancer is distinctly higher among the prosperous and well-to-do than among the wage-earning element, including the less prosperous and the poor.

The foregoing observations and conclusions touch only the fringe of a vast problem of the greatest possible importance to the public: the life insurance companies, which are engaged in the business of assuming risks conditioned by the duration of life, and the medical and surgical profession, but for whose combined efforts and relatively high degree of professional efficiency the mortality from malignant disease would be much greater than is actually the case. The time has come for concerted action in the direction of educating the public at large in the earliest possible symptoms of even pre-cancerous conditions, or predisposing states of the tissues, on the one hand, and the efficacy of the earliest possible operative treatment, on the other. The public requires to be made familiar with the accepted facts of surgical experience, which, for illustration, in the case of operations for cancer of the breast show a reduction in the primary mortality, from 25 per cent in pre-antiseptic days to less than 1 per cent at the present time; and a further reduction, according to Deaver, in the probability of local recurrence from 65.6 per cent to only 6.5 per cent. The initial symptoms require to be treated on the part of the public with more seriousness than is usually the case, and also the advisability of the earliest possible qualified medical and surgical treatment as an essential prerequisite for the obtaining of a cure, or at least a material prolongation of life. It is far better to overrate the seriousness of even apparently non-malignant tumors than to underrate the terrible possibilities of ultimate changes or degeneration from benign into malignant tumors. Even the occurrence of warts and pigmented moles requires to be looked upon as a possibly pre-cancerous condition, and certainly every lump in the breast, or continuous local pain, should suggest the possibility of malignant disease. In the case of cancer of the uterus there can no longer be a question of doubt but that permanently successful results are obtained by the earliest possible operative treatment, but that even a comparatively short delay is frequently followed by fatal results. The many excellent suggestions which have been advanced by Winter, of Koenigsburg, and those who have followed his teachings, are bound, in the course of time, to result in a material reduction in the now excessive mortality from this most terrible affliction. The mortality from practically all other forms of cancer can be reduced by operative treatment provided, on the one hand, the cases are brought early to the attention of qualified surgeons, and, on the other, that medical practitioners improve in methods of diagnosis, and with all the power at their command urge against fatuous reliance upon other than surgical methods of ultimate treatment.

As a further step in qualified and practical cancer research, the experience of American surgeons and American hospitals should be brought together in a convenient form and subjected to critical analysis, for the purpose of disclosing the lessons of the actual experience and the changes and results under past and present methods of operative treatment. The literature of cancer is now so enormous that it defies the understanding of any one mind in even a single specialized direction, chiefly on account of the want of really trustworthy data on any and all important phases of the cancer problem in its relation to the medical and surgical profession, the life insurance companies, the public, and the State. It would, therefore, seem eminently proper and fitting for the Clinical Congress

of Surgeons of North America to initiate a rigid collective inquiry into the facts of American surgical experience, with regard to the immediate and after-effects of surgical operations for malignant and non-malignant tumors, with a due regard, of course, to the numerous details, such as age and sex, previous duration, physical condition at the time of operation, methods of treatment, and after-care. A vast amount of information exists but is practically unavailable to the public at large and to most of the practicing physicians and surgeons out of contact with the large medical libraries of large cities. There are the strongest possible reasons for believing, however, that if the cancer facts, including medical and surgical experience, were brought together in an authoritative form, they would not only materially aid the work of the American Society for the Control of Cancer, but the various cancer research funds, as well as the individual practitioner in his relations to the patients and the public at large. With this end in view, however, it is necessary that there should be intelligent and active coöperation between the laity and the profession, on the one hand; and the life insurance companies, and the federal and state governments, on the other. If, by means of such coöperation, the present upward tendency of the cancer death rate is only halted, and if, by indefatigable efforts, even a slight reduction in the rate from any or several forms of cancerous affections is brought about, the results will be well worth while, and the work done will be a genuine contribution to the well-being of civilized mankind.

DEATH OF A FULL-TERM FŒTUS DUE TO CONSTRICTION OF THE UMBILICAL CORD BY AMNIOTIC BANDS; RUPTURE OF AMNION; HYDRAMNIOS[1]

By EUGENE CARY, S. B., M. D., Chicago

THE existence of amniotic bands during prenatal life was described as early as 1812. Medical literature is full of such cases. These bands give rise to many pathological conditions of the fœtus such as malformations, intra-uterine amputations and constriction of the umbilical cord. It is not, however, the purpose of this article to consider this subject in all its ramifications, but rather to concentrate upon a consideration of amniotic bands which constrict the umbilical cord and cause the death of the fœtus.

Much has been written as to the origin of these bands. In 1830, Montgomery advanced the theory that these bands were formed by organized lymph. Later, Simpson of Edinburgh, Simonart, Virchow, and others believed their origin to be due to an inflammatory process. In 1854, C. Braun first voiced the opinion that these so-called Simonart's bands originated from an abnormal folding-in of the membrane due to an insufficient quantity of amniotic fluid during early embryonic life. Küstner, in an article written in 1889, upholds this same view.

Lvoff believes these bands to be due to some faulty development of the amnion and that the bands begin as a folding of the membrane, but it is his belief that this folding occurs when the embryo first separates from the amnion. He states further that at first these bands lie close to the amniotic sac and cause no danger to the fœtus, but as the amniotic sac enlarges they stretch, and lie free in the fluid. Thus movements behind them on the part of the fœtus may entangle some member, or even the cord, causing malformations, malnutrition, or death.

Another etiological factor in the origin of these bands was put forward about 1890, by Küstner, Olshausen, and others. They believed that rupture of the amnion led to the formation of broad bands that later became adherent to the fœtus. Küstner describes a

[1]Read before the Chicago Gynecological Society, January 16, 1914. (See discussion, p. 776.)

case of congential amputation of the hands and feet by amniotic bands. These he thinks resulted from a ruptured amnion due to the mother's lifting a heavy load in the second month of pregnancy. In this case the amnion had entwined itself about the cord, but had not compressed it enough to cut off fœtal circulation.

Rupture of the amnion alone during the first half of pregnancy has been reported in a considerable number of cases. Stoechel, in 1905, says: "The amnion is a firm, resistant membrane, but it alone (as opposed to the chorion) may rupture during the early months of pregnancy." Of this condition he cites twelve cases collected by v. Myer-Runge (Braun, Olshausen, Bar, 2; Maygrier, Lebedeff, Osmont de Caseu, Crouzat et Payrari, Maroger, Myer-Runge, each one case). He has also observed that after the amnion has ruptured it quickly retracts and shrinks down into a little rolled-up pouch which surrounds the insertion of the cord into the placenta like a cuff. In May-Grier's case, bands from the ruptured amnion had caused spontaneous amputations of the fingers and toes and encircling bands were bound around the cord itself. In another case the constriction of the cord was so great that the death of the fœtus resulted.

Stoechel asks: "Did these bands originate after rupture of the amnion, as Olshausen believes, or were they present before the rupture as Simonart's threads?" It is my belief that the rupture of the amnion had a great deal to do with the formation of bands in these cases, especially if two or more rents occurred before shrinkage took place, and it seems more than a mere coincidence that they should have occurred in nearly every case in which the amnion had ruptured prematurely.

In all the cases of rupture of the amnion before term that were collected, the rupture occurred during the first half of gestation with the exception of one case reported by G. Braun of Vienna, in 1865. Braun is indefinite as to just how near term the rupture occurred, but states that eight days before delivery fœtal movements and fœtal heart tones were plainly discernible. After delivery the amnion was found freshly torn and the cord constricted by a band of this torn amnion looped about it.

This brings us to a consideration of the case which I have to report:

Mrs. X., a two-para, 32 years old, entered St. Luke's Hospital September 18th at 9:30 P. M., in the first stage of labor, the membranes having ruptured just prior to her entrance.

She is American born and has been married six years. She has one child and has never had a miscarriage. Her menses began at fourteen years of age and since then have been of the regular twenty-eight-day type. Her first pregnancy and puerperium was normal; her previous history negative.

The date of her last menstrual period was December 21, 1912, and she felt "life" May 10, 1913. During the pregnancy urinalysis disclosed a trace of albumin and a few hyaline casts with a rather low specific gravity (1.006) at two different periods, all of which readily cleared up under treatment.

During the latter months of pregnancy she developed a condition of hydramnios. Aside from

Fig. 1.

the above conditions the pregnancy was uneventful until two days before the onset of labor, when she was disturbed by "excessive kicking of the baby." After this unusual demonstration of "life" the fœtal movements, as far as she could tell, ceased. This occurred September 16th, and was not reported at the time.

Labor pains began September 18th at 8 P. M., just after rupture of the membranes. The patient immediately went to the hospital for confinement. On examination, the head was found in the left occipito-anterior position, but neither fœtal heart tones nor fœtal movements could be detected.

Labor progressed normally, and September 19th at 9:30 A. M. the patient was delivered of a slightly macerated female fœtus, 57 cm. long, weighing 3,344.3 grams. Thirty minutes later the placenta was delivered spontaneously. The cord was centrally implanted. The chorionic membrane was intact, but there was only a short fringe of the amniotic membrane about 10 cm. long left around the insertion of the cord into the placenta. The remaining portion of the amnion was wrapped about the cord 22 cm. from the fœtus (Fig. 1).

The puerperium was uneventful.

The cord is of about the average length (52 cm.), but thicker than normal. There

is considerably more Wharton's jelly than is usually found and the cord has the feel of being waterlogged. About 25 cm. from the umbilicus is a constriction composed of two firm bands of tissue that have knotted together. These bands or small ropes are composed of shredded amniotic membrane rolled up to be very resistant to considerable strain. They can, however, be readily unrolled.

The constriction of the cord is so firm that not only is all the circulation shut off, but even the Wharton's jelly in that region is also pushed aside.

In this case it is seen that the amnion was ruptured and was represented only by a fringe around the placental insertion of the cord. To substantiate the statement that it is a recent rupture and not one occurring early in pregnancy, we find that the fringe is not retracted or shrunken, that there are no adhesions between it and the fœtus, that there are no malformations of the fœtus, and lastly, that the chorion is not thickened and is not firmly adherent to the lining of the uterus. I say that the chorion is not thickened or adherent because, in cases reported by Lebedeff, where the amniotic membrane is absent, there is an inflamation of the chorion which he attributes to the presence of the excretory products of the fœtus.

The main issue of my case is, of course, the condition that directly caused the death of the fœtus. The cause was constriction of the cord, cutting off fœtal circulation by two bands of recently torn amniotic membrane. In this case the amnion undoubtedly ruptured under the strain put upon it by the condition present, namely hydramnios. After the tear had occurred the amniotic fluid dissected the amnion from the chorion, and allowed the former to float free in the sac. The movements of the fœtus soon tore this into shreds which rolled up to form membranous ropes in the form of loops around the child, the fixed end of the loop necessarily being at the insertion of the cord into the placenta. From the findings, it seems probable that the whole free, floating portion of the amnion was twisted into two such ropes which happened to cross where they both passed by the umbilical cord. In this way the movements of the fœtus managed to tie a knot in the bands around the cord. The fact that both ends of these bands were anchored made every movement of the fœtus draw the knot firmer, and as partial asphyxia set in, the movements becoming more violent and, the ropes holding, the cord was totally constricted and death of the fœtus resulted from asphyxia.

It is interesting to note that in the literature on this subject I have been unable to find a single case cited where *hydramnios* had caused a late rupture of the amnion, which in turn constricted the cord and so caused the death of the fœtus. Friedrich Ahlfeld, however, says: "Any case of hydramnios predisposes to pathological conditions of the mother or child." Chiari says: "Viewed from the standpoint of pathological anatomy, it is not impossible that malformations and even death of the fœtus may result from an abnormally spacious amnion, or from a premature collection of amniotic fluid. Yet actual observations have not been made to substantiate this opinion." As regards this statement it is interesting to note, in passing, that Ahlfeld reports a case of club-foot occurring in a fœtus where a condition of hydramnios was present complicating a twin pregnancy. Burstal found four deformities in 133 cases of hydramnios, but no adhesions.

I should like to quote fully the following case by Lvoff, reported in 1898, which has not yet been translated from the Russian. It is a case in which death of the fœtus was caused by constriction of the cord on account of being caught in the loop of an amniotic band, but in his case the amnion was intact. His case was as follows:

"I was called on a case on account of malposition, VI-para. Pregnancy was normal with labor at term. Fœtus was alive during pregnancy and fœtal movements were obtained two hours after labor began, when they ceased.

"Examination revealed the fœtus lying in the transverse position; membranes not ruptured but bulging. Fœtus lay high up and no heart tones could be heard.

"Version was hastily performed. The sac was ruptured near the placental margin, releasing meconium stained water. The child was born dead and its color was cyanotic.

"The cord was of the average length with no irregularities. In looking for the cause of death in the placenta and membranes it was found that death was caused by a tightly drawn loop formed of an amniotic thread, constricting the cord at a distance of one-third its length from the fœtus.

"This amniotic band originated at the insertion of the cord into the placenta from which point it extended parallel to the cord, free through the amniotic fluid, to where it looped around the cord. From here it passed, free again, to its attachment on the lining of the amniotic sac, where was the rent through which the version had been done. The amnion was found to be intact, normally developed and everywhere adherent to the chorion."

In conclusion I wish to thank Dr. I. J. Franklin for the necessary aid he gave me in translating Lvoff's article from the Russian. In fact, it was really the first reference I found that shed any light at all on the work in hand.

From a careful review of all the literature on this subject I could find, I was able to obtain only one case that is similar to mine, and that is reported by C. Braun. In his case the amnion ruptured late and shreds of this ruptured membrane constricted the cord and caused death eight days before the onset of labor. Lvoff's case was somewhat similar, as the cord was constricted by an amniotic band, but the etiological factor was altogether different, for in Lvoff's case the amnion did not rupture.

The rupture of the amnion was undoubtedly due to over-distention from the condition of hydramnios present, and thus another possible complication may be added as a result of this condition of over-distention.

A sudden increase in the activity of the fœtus in the latter part of pregnancy should lead one to suspect compression of the cord from some cause threatening the life of the fœtus. This fact is emphasized by Jones in a case in which circulation was cut off by looping of the funis around the legs of the fœtus two months before term.

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CLINICAL AND EXPERIMENTAL RESULTS OF STREPTOCOCCIC INFECTIONS WITH SPECIAL REFERENCE TO ARTHRITIS AND ITS TREATMENT[1]

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THE purpose of this paper is to discuss certain clinical and experimental data associated with streptococcic infections, with special reference to their localization in joints and their treatment.

Streptococcic infections with the clinical manifestations of septicæmia originating from a puerperal infection, a post-mortem wound, or by inoculation of an abrasion of the skin or mucosa, have been recognized for a long time. However, the so-called cryptogenetic and epidemic forms have been less thoroughly studied. I believe the term "cryptogenetic" should be abandoned, inasmuch as it is highly probable that some microscopic lesion of the skin or mucosa is the atrium of infection when no gross change is found.

Streptococci may reach the blood through tonsils showing little or no pathologic change, on superficial examination. It is a significant fact, however, that cultures and smears taken from the surface of tonsils may bear no relation to the organisms recovered from the crypts or cut surfaces of the same organs.[1]

Escherish has noted in children enteritis following the ingestion of milk infected with streptococci and in this manner the body invaded by the germs. It is also possible that streptococci entering the gastro-intestinal canal with milk or food may pass through the normal tissues of the bowel into the lymphatics and then via the thoracic duct into the blood, as it has been shown experimentally that tubercle bacilli fed to dogs reach the blood-current through the same route. Abrasions or operative wounds of the upper respiratory passages or oral cavity permit direct inoculation of the blood or lymphatics.

Acute and chronic lesions of the joints, heart, and kidneys are frequently associated with streptococcic throat infections. In a series of 28 cases of chronic arthritis associated with tonsillitis, Davis recovered hæmolytic streptococci from the crypts of the tonsils and there was reason to believe that these organisms were causally related to the joint lesions. These streptococci readily produced arthritis in rabbits, when given intravenously, and Dr. Jackson in a paper recently published explains the localization of these experimental streptococcic infections in the joints upon anatomic grounds. It would appear from her results that the organism through an embolic process in the minute subsynovial capillaries invades early the joint cavities directly. Endocarditis, as well as arthritis, was also produced by the streptococci in a number of instances.

As bearing upon this subject I may refer to some clinical data which have come under my personal observation, viz.:

Mrs. L. had had repeated attacks of acute tonsillitis and arthritis finally terminating in endocarditis. The tonsils were removed during the illness, as they were greatly hypertrophied and showed acute inflammation. Cultures and smears from the surface of the tonsils showed only pneumococci and staphylococci, while cultures and smears from the cut surface and crypts showed pure growths of streptococci. Injection of a large rabbit intraperitoneally with a 24-hour culture suspended in salt solution caused death of the animal in 24 hours. Intravenous injections of this organism were not made.

Mr. J. in February, 1912, submitted to a submucous resection of a deflected nasal septum. Considerable hæmorrhage occurred and the nares were tightly packed with gauze. One week later the patient had a severe rigor with temperature of 102° and rapid pulse. The packing was removed from the nares, permitting the escape of a considerable quantity of a dirty dark fluid. On the following day the right knee became red, tender, and swollen, and movements of the joint were exquisitely painful. On the succeeding days there was continued elevation of temperature, rapid pulse, drenching sweats and successive involvement of the larger joints, so that almost any movement was impossible. Marked atrophy of the muscles occurred, especially of the interossei. A systolic murmur at the base of the heart appeared one week after the initial chill.

[1] Wruslow: Bull. Johns Hopkins Hosp.
Hamburger: J. Infect. Dis.
Miller and Capps: J. Am. M. Ass.
D. J. Davis.

[1] Read before the Chicago Surgical Society, February 6, 1914. (See discussion, p. 774).

Cultures made from the blood were negative, but the streptococcus was found in pure culture in the throat. Acute suppurative otitis media occurred early in the disease. Paracentesis relieved the symptoms and permitted a free discharge of pus. At the end of the second week a massive generalized furunculosis occurred. The furuncles contained staphylococci and cleared up with vaccine treatment.

Partial recovery, with deformities of most of the large joints associated with limitation of motion and muscular atrophy, followed. As a result of the endocarditis, a mitral incompetency exists at present. Medication, in this case including the use of antistreptococcic serum and phylacogen, was of no avail. The disease apparently ran a self-limited course. No injections or aspirations of the joints were undertaken nor was extension by means of a weight and pulley made.

These two cases serve to illustrate how infection with the streptococcus may take place both through the nasal mucosa and through the tonsils. The marked wasting of the muscles in this case is a striking illustration of the rapid muscular degeneration both of the striped and unstriped tissues as a result of the absorption of toxic material.

Many methods have been advanced for the treatment of acute joint infections. These may be briefly classified as follows:

(*a*) Local. 1. Medical treatment: This includes rest of the affected joint, application of heat or cold, application of drugs or poultices, and bandaging. 2. Surgical treatment: This embraces, immobilization of the part by casts or splints, Bier's hyperæmia, aspiration of the fluid content of the joint cavity and injection of drugs, extension by weight and pulley, incision and drainage, and irrigation.

(*b*) General treatment consists of the administration of various drugs, sera, and vaccines.

Spitzer [1] endorses the use of Bier's hyperæmia, compression, and the use of hot air in the treatment of all forms of infectious arthritis whether polyarticular or monarticular. Inasmuch as drug and mechanical treatments are notoriously uncertain and the antistreptococcic serum is more often a failure than a success, he believes that the ultimate successful treatment will be by means of a polyvalent serum.

[1] Spitzer, Neuere Behandlungs formen des akuten Gelenk Rheumatismus. Med. Klin., Berl., 1909, v, 1668.

Mendel [2] and numerous others have used subcutaneous injections in acute infective arthritis. Jackson [3] used intra-articular injections of a solution of magnesium sulphate in acute arthritis without good results.

Porter [4] has discontinued the use of intra-articular injections of formalin in olive oil or iodoform emulsion in chronic joint infections and reports good results with their use only when the arthritis is acute and confined to the synovial membrane. Murphy strongly endorses the use of two per cent formalin in glycerin in all forms of joint infections and extends the application to infections of the pleura.

This solution of formalin appears to cause no serious results even when injected intravenously in a quantity as high as 10 ccm. Three years ago the writer injected a series of dogs of various sizes intravenously with varying amounts of this solution and was never able to observe any harmful effects upon the animals.

Capps and Lewis [5] found intrapleural injections of two per cent formalin in glycerin in dogs rapidly fatal when injected into an empyema which had been produced experimentally.

As a result of the above mentioned cases together with several other streptococcic infections, it was decided to investigate the matter from the experimental side with a view of determining the effect of the injection of certain substances into and about the joints of animals. Therefore a number of rabbits were inoculated intravenously, with 24-hour cultures of arthritis-producing streptococci suspended in normal salt solution. The strain of streptococcus used was recovered from the crypts of tonsils removed from a patient suffering with chronic infective arthritis.

A medium-sized rabbit was used. The joints of both legs on the right side (elbow, wrist, knee, ankle) were injected with a solution of two per cent formalin in glycerin. Simultaneously an intravenous injection of

[2] Mendel, Salicylates in Rheumatism, Therap. Monatschr., 1904, iv.

[3] Jackson, Injection Magnesium Sulphate for Acute Articular Rheumatism. N. Y. M. J., 1911, xciii, 1223.

[4] Porter, John L., Surg., Gynec., & Obst. 1913, March.

[5] Capps & Lewis, Arch.

two 24-hour blood-agar cultures of a strain of an arthritis-producing streptococcus was made. The animal died in forty hours.

Post-mortem examination showed the joints swollen and containing turbid fluid. Cultures made from all joints, both those previously injected with formalin solution and those not injected, showed luxuriant growths of streptococci. Cultures from the heart's blood also showed streptococci. The most marked pathologic change occurred in those joints which had previously been injected with formalin-glycerin solution. The explanation of this finding seems to lie in the fact that the intensely irritating formalin primarily devitalized the delicate synovial membrane to such an extent that it was less able to resist infection than when in normal condition.

A number of other rabbits were treated in the same manner; viz., by the intravenous injection of 10 ccm. of a 24-hour culture of streptococci suspended in normal salt solution. Simultaneously certain of the large joints were injected with a solution of two per cent formalin in glycerin and a record kept of the joints so treated. In each animal swelling and stiffness of the joints developed in from 24 to 72 hours, together with symptoms of severe intoxication. The rabbits appeared to be sick, refused to eat, and lost weight perceptibly. In some cases after a few days there appeared to be an improvement in the general condition, which proved to be only temporary, all the animals finally dying of septicæmia.

Clinically, the swelling and stiffness in the formalin-injected joints were uniformly most marked and this corresponded with the more advanced pathologic changes found post-mortem in the joints treated with formalin solution.

Both cultures and smears showed the presence of streptococci in each of the formalin-injected joints, as well as in the joints not so treated. In some of the inoculated rabbits, vegetations were found on the valvular endocardium.

Another series of rabbits was treated by the intravenous injection of 10 ccm. of a 24-hour culture of streptococci suspended in normal salt solution, and at the same time several of the larger joints were injected with a ten per cent emulsion of iodoform; these joints were marked with a solution of eosin for the purpose of identification.

October 26, 1912, Animal No. 6. A medium-sized rabbit was injected with a 24-hour culture of streptococci suspended in normal salt solution. The left knee and ankle joints were injected with ten per cent emulsion of iodoform in glycerin. Eight hours later joint involvement was most pronounced in the joints injected with iodoform emulsion. The rabbit appeared sick and moved with difficulty and died on the fifth day. Post-mortem examination revealed a multiple suppurative arthritis, most marked in injected joints. Heart's blood showed streptococci in pure culture.

October 30, 1912, Animal No. 7. A medium-sized brown rabbit was injected intravenously with 2 ccm. of a 24-hour culture of streptococci. No joint involvement followed. Three days later another injection of 4 ccm. of a 24-hour culture of streptococci suspended in salt solution was made. Forty-eight hours later a marked stiffness in the joints occurred, but no swelling. The rabbit moved slowly and with pain. An intravenous injection of 3 ccm. of a 25 per cent solution of sodium salicylate was administered. The following day a marked improvement in stiffness was noted, but after 48 hours the stiffness became again pronounced.

A reinjection of 1 gm. of 25 per cent sodium salicylate intravenously. The rabbit grew progressively weaker, developing swellings about the larger joints, with the exception of one leg, and died two weeks after inoculation. Post-mortem examination showed pus in large quantities in the larger joints, in one of which it infiltrated the muscles. The heart showed no changes. Smears and cultures from pus in the joints showed streptococci. Cultures from the heart's blood also yielded streptococci.[1]

Our results in this series of animals were uniformly similar to those obtained in the animals injected with formalin solution. The

[1] It seems evident that the intravenous injection of a 25 per cent sodium salicylate solution, given either once or repeatedly, has no influence upon the general course of the infection.

clinical and post-mortem findings were most exaggerated in the joints injected with the iodoform emulsion as compared with the joints not so treated.

Pure cultures of streptococci were recovered from each of the joints previously injected with iodoform emulsion, as well as from the joints not so treated.

As it was evident from the results obtained in the formalin- and iodoform-injected joints that neither of these substances protected the joint against the streptococcic infection, it was decided to attempt to protect the entire animal by intravenous injections of a solution of sodium salicylate in water at the time of the intravenous inoculation of the streptococcus.

In a careful search of the literature no record could be found of the intravenous injection of sodium solution. However, solutions of sodium salicylate in from 10 to 20 per cent strength have been given clinically by the subcutaneous method. To obtain any results, several injections must be made daily, thus necessitating the use of cocaine or of some other local anæsthetic, a procedure which, however, is exceedingly painful and prone to produce localized abscesses. The tendency to furunculosis in patients suffering from acute articular rheumatism, as a result of the drenching sweats, is well known, hence the liability to abscess formation would be all the greater, if repeated injections of salicylate solutions were given. Mendel reports favorable results following the injection of an 18 per cent sodium salicylate solution into chronic rheumatic joints.

The following experiments were, therefore, undertaken with the idea of determining the influence of intravenous injections of sodium salicylate upon rabbits inoculated intravenously with arthritis-producing streptococci.

A medium-sized rabbit was injected intravenously with a 24-hour culture of streptococci suspended in salt solution. Simultaneously an intravenous injection of 1 gm. of a 25 per cent aqueous solution of sodium salicylate was made. At the same time, as a control experiment, a medium-sized black rabbit was given a similar injection of streptococci, but without the injection of the solution of sodium salicylate. Two days later a marked stiffness was noted in the black rabbit, which had not received the sodium salicylate injection, while the white one appeared much more active and was reinjected with 1 gm. of a 25 per cent solution of sodium salicylate intravenously. One week later both animals developed multiple pus infections in their joints and died. Cultures and smears from the joints showed streptococci.

In the rabbits used in the above experiments no rigors were noticed. The animals frequently appeared sick and apathetic after 12 hours. Movement of the legs was painful and the animals crouched down in their cages with their joints flexed. In from 24 to 36 hours, in many cases, painful, fluctuating swellings of the larger joints were observed and these swellings persisted until death. Unlike the clinical picture of acute articular rheumatism, there was not the fugitive involvement of the joints but rather a more or less simultaneous attack on all the larger joints, and none of the joints so attacked showed any tendency to heal. No bony ankylosis occurred, but, as the animals died in so short a time, it is impossible to say whether ankylosis might not have occurred later.

All the animals became rapidly emaciated and presented the appearance of a severe acute intoxication, and, although some of them lived as long as two weeks, all finally died of a streptococcic septicæmia.

Davis has been able to regulate the dose in such a manner that he has succeeded in producing multiple suppurative arthritis without causing the death of the animal. In his series of animals many of the articular lesions subsided and the animals recovered without any clinical evidence of permanent changes in the joints, while in others the arthritis became chronic, causing destruction of the articular surfaces of the bones and the periarticular soft tissues. In four of his animals joint changes occurred simulating arthritis deformans, but after several months the enlargement entirely subsided.

SUMMARY

1. In each animal multiple suppurative arthritis developed in from 24 to 72 hours,

depending upon the amount of streptococci injected, and this occurred regardless of whether attempts had been made to protect certain joints by injections of different solutions, or to protect the entire animal by intravenous injections of sodium salicylate.

2. Swelling and stiffness of the larger joints were noticed after 24 to 48 hours in all cases.

3. Post-mortem, thick purulent material was found in the joints which could be scraped away leaving the synovial membrane dull and lusterless.

4. Destruction of articular surfaces of bones, ligaments, and cartilages may occur when the animals do not succumb too early to streptococcic septicæmia.

5. Cultures from the heart's blood and from the pus from joints in the animals used gave pure cultures of streptococci.

6. The greatest pathologic changes occurred in those joints in which attempts had been made to protect them by injections of formalin or iodoform.

7. Intravenous or intra-articular injections of sodium salicylate in solutions as strong as 25 per cent have no permanent effect upon streptococcic arthritis.

8. Intra-articular injections of solutions of formalin in glycerin or iodoform emulsion do not protect the joints so treated.

9. Aspiration of the pus and injection of antiseptic solutions after infection of a joint had taken place did not give favorable results in the animals injected intravenously with streptococci.

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THE RÖNTGEN FINDINGS IN GASTRIC AND DUODENAL ULCER[1]

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IN attempting to summarize our present knowledge of the X-ray method in studying gastric and duodenal ulcers, I recognize that new facts are being developed daily in this newest of the accessory means of clinical study of the alimentary tract. The present-day scarcity of textbooks in röntgenology is easily explained when one considers the rapid advances being made from year to year and even from month to month. This is especially true in relation to the gastro-intestinal tract. This field of röntgenologic study still remains, in a large measure, virgin soil. There must yet be large series of cases studied by the röntgen ray and checked up rigidly by the findings of the surgeon and the pathologist.

Gastro-intestinal röntgenology is in its infancy and needs all the help to be derived from other departments of clinical research. The child's mistakes do not negative his potential worth as a man. An attitude of helpful and friendly critical suggestions will surely serve best in considering the value of this means of clinical study.

The röntgen evidences of ulcer of the stomach and duodenum may be classified under the following heads:

1. Bismuth flecks representing ulcer craters filled with bismuth.
2. Filling defects in the stomach shadow.
3. Organic deformities of the stomach other than filling defects. These various phenomena constitute what may be called the *definite* X-ray evidences of ulcer.

Under the head of *inferential* evidence may be classified:

4. Spastic manifestations.
5. Abnormalities of peristaltic waves.
6. Abnormal emptying time of the stomach.
7. Unusual filling of the duodenum.
8. Pressure pain points.

These evidences will be considered in the order named.

Bismuth flecks representing ulcer craters filled with bismuth. The first suggestion with relation to gastric ulcer heard from one unfamiliar with X-ray examinations of the alimentary tract is that the crater of the ulcer should accumulate bismuth and thus cast a shadow visible on the screen or röntgenogram. In other words, it is the popular idea that the ulcer itself should show. As a matter of fact, however, experience has shown that it is rare indeed for an ulcer to show in this manner. Aside from the penetrating ulcers at about the middle of the lesser curvature, I have had only eight or ten proven cases (by operation) in which the crater filled with bismuth; and several of these were so near perforation that after exposing the stomach and before proceeding to the necessary surgical procedure, the surgeon felt obliged to reënforce the tissues at the site of the ulcer to prevent possible rupture during manipulation. Aside from these penetrating ulcers on the lesser curvature, and ulcers of the duodenum, I have encountered only four cases where the bismuth fleck in the stomach corresponded to a gastric ulcer.

Penetrating ulcers of the lesser curvature, the X-ray findings in which were first described by Haudek, will be considered under another head.

Flecks in the duodenum representing flecks in the crater of an ulcer may be confused with a number of shadows, as, for instance, bismuth flecks in the ampulla of Vater. This bismuth fleck is not easily demonstrated as being in the ampulla unless one manages to fill the duodenum at the same time the ampulla is made to show. I have a few such cases. Dr. L. G. Cole has also called attention to this source of error. Other confusing shadows which may be mistaken for the ulcer crater filled with bismuth are right renal calculi, small gall-stones and bismuth residues in the gall-bladder following cholecystenterostomy. I know of at least one case in which bismuth was found in the

[1] Read by invitation before the Chicago Surgical Society, December 5, 1913. (See discussion, p. 771.)

gall-bladder following spontaneous cholecystenterostomy. Normally, a small portion of bismuth persists in the first portion of the duodenum, the duodenal bulb, for some time after the stomach is completely emptied.

Filling defects in the stomach shadow. Defective filling of the stomach with the resulting defective shadow is most characteristic of carcinomatous invasion of the stomach, but it may also be seen in connection with inflammatory masses attending gastric ulcer. Defects in the duodenal bulb constitute one of the chief röntgenographic means of recognition of duodenal ulcer and its complications.

Filling defects on the lesser curvature are to be differentiated from carcinoma and rarely from syphilis and tuberculosis. I do not know of any way to differentiate from the X-ray findings alone between the defect caused by a small carcinoma and that caused by a callous ulcer (Fig. 11). The surgeon himself is sometimes unable to differentiate when he has the lesion between his fingers.

I am able to report and show the slides of a case of tuberculous ulceration of the stomach. This ulcer occurred on the greater curvature at the junction of the middle and lower thirds, measuring about two and a half inches by an inch and a half.

Instead of producing a filling defect, lesser curvature ulcers, as a matter of fact, may produce a projection from the stomach shadow. The size of the projection may vary from the scarcely discernible nodule upon the stomach shadow to a typical penetrating ulcer of the type described röntgenologically by Haudek.

Defects in the shadow of the duodenal bulb are rather common. Their discovery by means of the röntgen ray has been popularized by Cole in this country and later by George and Gerber. According to Moynihan, 95 per cent of duodenal ulcers occur in the first part of the duodenum, the so-called bulbus duodeni. The normal shadow of the duodenal bulb has been carefully studied by Cole and others and slight variations from the normal are easily recognized. Abnormal shadows of the duodenal bulb, the so-called "pilleus ventriculi" of Cole, may result from penetration or perforation of a chronic ulcer, cicatricial contraction, stenosis, pressure upon the duodenal bulb of extra-duodenal tumors, adhesions resulting from gall-bladder or pancreatic disease. Occasionally sacculations of the duodenal bulb may be demonstrated. Filling defects in the duodenal shadow, to be interpreted as ulcer, should be differentiated from the normal defects due to the hepaticoduodenal ligament and the deformities of the bulb due to extraduodenal pressure, as, for instance, gall-bladder, blood-vessels, second portion of the duodenum, etc. The defects due to gall-bladder region adhesions are very characteristic; the defect occurs on the gall-bladder side of the duodenal bulb shadow, but the bulb is otherwise anatomically normal.

Complete or nearly complete absence of the duodenal bulb is frequently seen in duodenal ulcer with extensive periduodenal adhesions, in carcinoma of the pancreas with extensive adhesions of the duodenum, and more frequently in pyloric or juxtapyloric ulcer with stenosis. In these cases the stomach presents an appearance to which the term "prognathian" has been applied by Cole, the dilatation of the stomach occurring mostly in the pyloric portion and presenting a very characteristic appearance.

George quotes Moynihan as stating that "a duodenal ulcer which has been the cause of protracted and recurrent symptoms is always visible from the outside of the intestine, is always palpable and, therefore, is always demonstrable," and adds to this the statement that there can be no exceptions.

While I place considerable dependence upon the deformity of the bismuth shadow in the demonstration of duodenal lesions, I am not content to rest the case upon this evidence alone. Other evidences, such as hyperperistalsis, hypertonicity, hypermotility, or early pyloric insufficiency with later pyloric spasm and delayed emptying, are some of the other signs that ought to be demonstrated in duodenal ulcer.

Organic deformities of the stomach other than filling defects. Under this head I especially wish to discuss the organic hour-glass deformities and the sacculation of the stomach often attending penetrating ulcer on the lesser curvature. As above stated, aside from cases of penetrating ulcer, one rarely finds a bis-

Fig. 1. Bismuth fleck (at arrows) seen six hours after a bismuth meal, marking the crater of an ulcer near penetration.

Fig. 2. Bismuth residue six hours after a meal in a case of penetrating ulcer of the duodenum; (a) bismuth fleck in crater of ulcer; (b) navel marker; (c) six-hour residue. Röntgenogram made with patient standing.

muth fleck which can be proven to be a bismuth accumulation in the crater of an ulcer. Penetrating ulcers on the lesser curvature frequently produce characteristic deformities which are röntgenographically demonstrable, according to the extent of penetration. The projecting bismuth shadow may vary from a small outcropping from the stomach shadow, scarcely discernible on the screen, to a large bismuth mass ten or fifteen centimeters in length and half as wide. Whether the projecting bismuth shadow or diverticulum has formed posteriorly in connection with adhesions and fixation to the pancreas, or anteriorly with adhesions to the liver, is easily observed by careful screen examination, turning the patient this way and that until by proper oblique illumination the location and extent of the perforation may be determined. The projecting shadow will be found to move up and down during respiration when the perforation is anterior in connection with the liver, but it will be immovable during respiration when the perforation and fixation have occurred in relation to the pancreas.

Perigastric adhesions distorting the stomach and interfering with gastric peristalsis are likely to occur, and are responsible, in part, for the hour-glass appearance often seen in these cases. This hour-glass deformity is usually partly spastic and partly organic — the spasm being due to gastric ulcer, the organic changes being due to the perigastric adhesions. These adhesions frequently fix the stomach and often extensively involve the neighboring organs. Many times the inflammatory mass attending perforated ulcer may be definitely felt and when palpated under the fluorescent screen examination may be definitely identified as belonging to the stomach shadow. In the typical penetrating ulcer, Haudek, Faulhaber, and others have described above the projecting bismuth shadow a small collection of gas which has the same relation to the small diverticulum as the "magenblase" or stomach bubble has to the stomach itself. This small collection

Fig. 3. Röntgenogram made twenty-eight hours after a bismuth meal showing a bismuth residue in the gall-bladder region, proven to be bismuth in the gall-bladder, having passed through the cholecystenterostomy opening.

of gas lying above the localized bismuth shadow in connection with the ulcer has, in fact, been termed the "little magenblase."

The presence of this extra shadow with a tumor mass having an evident connection with the stomach speaks for ulcer rather than carcinoma, especially when there is no encroachment upon the shadow of the stomach with the resulting filling defect characteristic of carcinoma. When the patient is examined in the erect position, it is frequently possible to demonstrate above the localized addition to the gastric shadow, the superimposed air bubble above described, which definitely marks the case as one of penetrating ulcer of the stomach.

The hour-glass formation, partly organic and partly spastic, frequently associated with ulcer on the lesser curvature, differs from the appearance seen in carcinomatous hour-glass stomach. In differentiating the ulcer from the carcinomatous condition, it may be stated that in hour-glass stomach due to ulcer there is frequently a residue of the bismuth meal after the sixth hour; the stoma between the upper and lower sacs lies along the lesser curvature, the outline of the greater curvature being drawn over toward the lesser; the narrowing occurs at one distinct point, and the canal is usually short. On the other hand, in carcinomatous hour-glass stomach, the narrow channel connecting the two sacs lies in the stomach axis and is much longer, and there is usually pyloric insufficiency.

Dilatation of the stomach of varying grades is a frequent finding in chronic gastric and duodenal ulcer. The so-called prognathian dilatation associated with stenosing pyloric ulcer has already been referred to. Marked gastric stasis without dilatation is suggestive of a malignant obstruction.

Spastic manifestations. A spastic indrawing on the greater curvature producing a sharply outlined localized indentation of the gastric wall, according to the early writers, was evidence of ulcer. It was at first stated that this spasm of the circular muscles of the stomach, which were in reality a deep tonic

Fig. 4. Bismuth-filled stomach and duodenum, the entire duodenum showing. The arrows point to a bismuth fleck seen within the curve of the duodenum. Repeated observation seemed to prove conclusively that this was bismuth in the ampulla of Vater. (Röntgenogram kindly loaned by Dr. L. G. Cole.)

constriction, was characteristic of lesions of the mucous membrane at the level of any given muscular ring. It was discovered, however, that these spastic disturbances were sometimes purely functional. At any rate, in many cases there was no discernible ulcer to be found. It was early admitted that these spastic indrawings might be seen in tabes and hysteria, as well as in gastric ulcer located on the lesser curvature at the level of the spastic indentation.

I reported before the Michigan State Medical Society, Surgical Section, 1913, sixteen operated cases in which such a spastic indrawing on the lesser curvature was proved by operation to be associated with well marked duodenal ulcer, no gastric ulcer being found at the level of the indrawing. In many of the cases, especially those in which gastro-enterostomy was done without clamps, the inside of the stomach was explored and no ulcer could be found. Among the other conditions in which this sign has been noted by the writer, and where anatomical proof has been afforded of the absence of ulcer on the lesser curvature at the level of the indrawing, have been a number of cases of gall-stones, carcinoma near the pylorus, appendicitis, and Grave's disease. Recently I have observed this sign in two cases of paralysis agitans. In fact, it seems that this spastic indrawing is a localized, especially deep tonic constriction of the stomach, the result of vagus irritation, and may be produced by any lesion which causes vagus irritation. The spasm is often overcome by the administration of atropine and it frequently fails to appear with the patient standing. With the patient lying, tension on the gastric walls being relaxed, the spasm occurs very characteristically. When it is due to ulcer on the lesser curvature there is usually a point of pain on pressure coinciding with the lesser curvature at the level of the spasm, and there is no special tenderness on pressure over the duodenal region. When the spasm is due to a duodenal lesion (gall-stones or duodenal ulcer) there is no pain on pressure over the lesser curvature at the level of the spastic indrawing, but there is usually pain on pressure under the

Fig. 6. A large collection of gall-stones found in a case diagnosed clinically as duodenal ulcer.

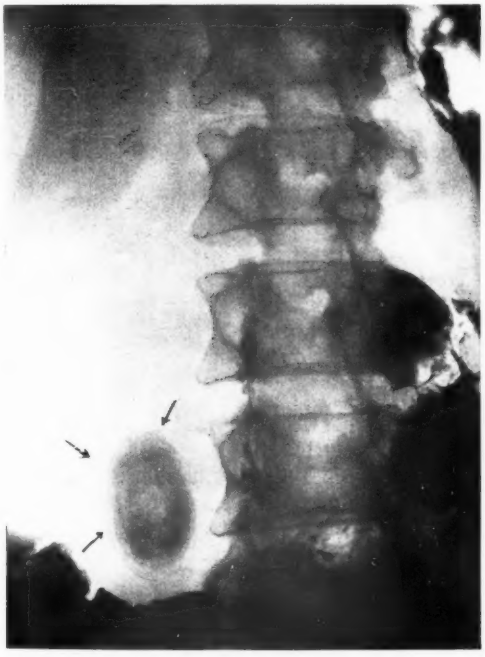


Fig. 5. A single laminated gall-stone found in a case of suspected duodenal ulcer.

Fig. 7. Case of hepatofixation due to adhesions attending gall-bladder disease. Two gall-stones seen to be present.

Fig. 8. Hepatofixation due to adhesions between the duodenum and gall-bladder. No gall-stones seen.

right costal margin, and manipulation of the pyloric or duodenal shadow is often seen to increase the depth of the spastic indrawing high up on the greater curvature. On screen examination, peristaltic waves are often seen beginning above this spastic manifestation and pass it without causing it to disappear. The persisting spastic indrawing on the greater curvature has also been observed in cases of carcinoma on the lesser curvature in the antral portion of the stomach, but the carcinomatous deformity may be differentiated by watching the peristaltic waves. When this indrawing is present with the patient standing, it is found to be extremely marked with the patient lying. On the other hand, this deformity often occurs with the patient lying supine when it is not seen at all with the patient standing. Sometimes these spasms are transient, being seen one day and not another. If the patient is under the influence of any spasm-relaxing drug, such as atropine, this spastic manifestation may be absent.

Of course, at operation these spastic manifestations are rarely seen. An hour-glass constriction which almost bisects the stomach in connection with a penetrating ulcer on the lesser curvature may be almost absent when the anæsthetized patient's abdomen is opened at operation.

Abnormalities of peristaltic waves. There is a certain variation in depth and frequency of the normal peristaltic waves, according to the tone of the stomach. When the depth of the peristaltic waves is increased and when they appear more frequently than the normal, the inference is that there is some obstruction at the gastric outlet. In pyloric obstruction, there is frequently observed a sort of systole and diastole similar to that which is claimed by Cole to occur in the normal stomach. Peristaltic waves may at one moment be practically absent and at other times so strong as to almost cut the stomach in two. It seems that this may represent fatigue and periods of revived activity after recuperation from fatigue. Hyperperistalsis and hypertonicity are both suggestive of duodenal ulcer.

Antiperistaltic waves, first described by Jonas, are pathognomonic of an organic lesion

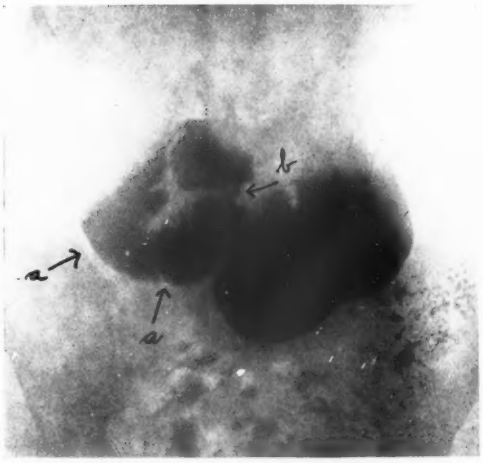


Fig. 9. Case of duodenal obstruction due to adhesions attending an ulcer on the lesser curvature just proximal to the pylorus.

Fig. 11. Deformity on lesser curvature corresponding to a callous ulcer.

Fig. 10. Deformity of the stomach due to ulcer on the lesser curvature two inches from the pylorus. Ulcer shown at arrow.

Fig. 12. Lateral röntgenogram of the stomach showing deformity of the posterior wall due to ulcer with attending cicatrix.

Fig. 13. Filling defect on the greater curvature, due to a large tuberculous ulcer.

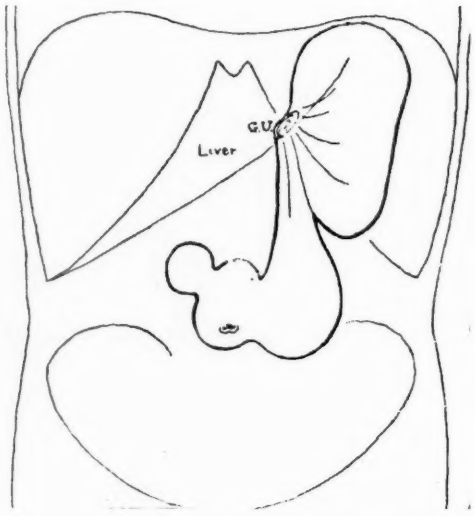


Fig. 14. Drawing (after Hertz) illustrating the deformity of the gastric shadow due to ulcer on the lesser curvature, which has become adherent to the liver.

near the pylorus and frequently point to ulcer. This organic lesion does not necessarily obstruct the pylorus. Antiperistalsis occurs with comparative rarity. I have seen about fifteen cases. Hertz stated as recently as last year that he had never seen it. This phenomenon is best studied when the patient is lying supine. Naturally such study must be made fluoroscopically.

Abnormal emptying time of the stomach. Six hours is the period which experience has suggested as the limit of the emptying of the normal stomach following the Rieder test meal, which consists of ten or twelve ounces of farina mush into which two ounces of bismuth oxychloride or subcarbonate have been stirred. The oxychloride is preferable to the subnitrate or subcarbonate. Neither one is necessary, since barium sulphate, a much cheaper substitute, can be very satisfactorily employed. Groedel and others have called attention to the fact that the use of barium sulphate shortens the emptying time of the stomach. The stomach in normal cases usually empties within three or four hours. The residue at the end of six hours may vary greatly from a small trace to practically all the stomach contents. In some cases, bismuth has been found in the stomach 125 or 150 hours following the bismuth meal. In these cases of prolonged stasis, the residue may become scarcely discernible because of the fact that the newly arriving food from each meal dilutes the bismuth contents of the stomach so that the proportion of bismuth is less from meal to meal.

Although Haudek claims that there can be no ulcer without spasm of the pylorus with a residue at the end of six hours, and that he has never seen a case where the emptying time was longer than six hours without serious alteration of the stomach wall, this claim is contrary to the experience of surgeons and many other röntgenologists. Recently Smithies has reported a hundred cases of gastric ulcer without delay in the emptying time. Many surgeons, basing their indication for operation upon the statement of Haudek, have been disappointed in finding no evidence of anatomical ulcer of the stomach where a six-hour residue has been demonstrated following a bismuth meal.

Fig. 15. Characteristic hour-glass deformity due to a penetrating ulcer on the lesser curvature, such as is illustrated in Fig. 14.

Fig. 17. Spastic indrawing (b) on greater curvature opposite ulcer on the lesser curvature. Normal pylorus shown at (c).

Fig. 16. Spastic indrawing (a) on the greater curvature, formerly considered pathognomonic of ulcer at the corresponding level on the lesser curvature; (b) represents a peristaltic wave which began above the spastic indrawing and fluoroscopically was seen to progress pyloruswards without disturbing the indrawing. It is now recognized that this spastic manifestation is not pathognomonic of gastric ulcer.

Fig. 18. Normal stomach and duodenal bulb. Pylorus at (a), bulbus duodeni or first portion of the duodenum at (b). This bulb, well filled out, should be demonstrable in every normal case.

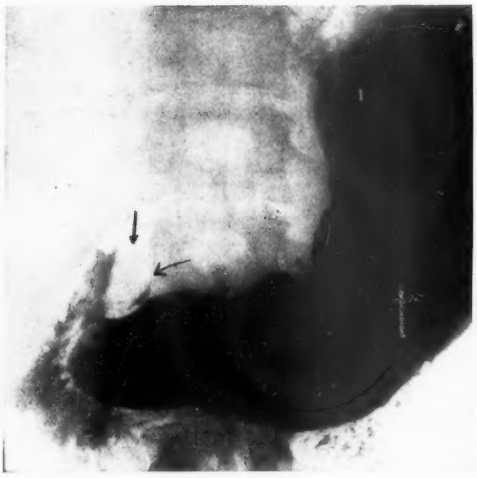


Fig. 19. Characteristic deformity of the duodenal bulb in a case of well-marked duodenal ulcer.

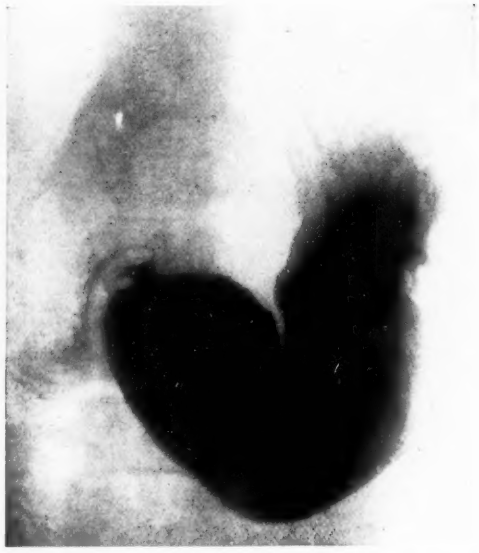


Fig. 20. Almost complete absence of the duodenal bulb in a case of perforating duodenal ulcer with considerable callous formation.

Early clearance of the stomach, when not due to achylia, may be found in cases of gall-bladder disease (with or without stone) and in pancreatic disease when adhesions to the duodenum are present, and in cases of duodenal ulcer. Cases of early malignant induration of the walls of the pylorus, rendering the pyloric sphincter inelastic, are not rare. In pyloric ulcer, with or without actual obstruction, there is delay in the emptying. Gastric ulcer (not pyloric) is not necessarily associated with delayed emptying. It must be admitted, however, that in many gastric and duodenal ulcers, the emptying time of the stomach, after a bismuth meal, is perfectly normal.

In duodenal ulcer it is a frequent observation that the stomach begins to empty at once and at a very rapid rate, bismuth being seen throughout the small intestine within a very short time. If the meal has not been a large one, the stomach may be entirely empty within an hour. When the meal is larger, delayed pylorospasm may be set up, and a small residue remaining longer than six hours may result. Duodenal ulcer cases which do not exhibit this quick emptying, at least during the first hour of digestion, are those where actual mechanical obstruction exists, as by cicatricial contraction. The above behavior of the stomach may be explained, perhaps, as indicating that when the meal is a large one the delay is due to the development of a tardy pylorospasm associated with a delayed hypersecretion.

In pyloric ulcer, on the other hand, suggestive findings are delayed motility with hypersecretion and *early* pylorospasm. As above stated, ulcer in the body of the stomach is not necessarily associated with an abnormal motility.

Unusual filling of the duodenum. The normal duodenal bulb has already been considered. This first portion of the duodenum normally shows as a symmetrical, smooth shadow, which has been called the "cap" or "pilleus ventriculi." The shadow is smooth by reason of the fact that there are no valvulæ conniventes in this portion of the duodenum. The bulb is not always well seen immediately after the ingestion of the bismuth meal, but it is usually well seen in the second hour of digestion.

The second and third portions of the duodenum are rarely well seen under normal con-

ditions. But in duodenal obstruction, duodenal ulcer, achylia, and gall-bladder disease the duodenum is frequently seen in its entirety. Unusually marked filling of the entire duodenum is frequently seen in cases of duodenal ulcer, and it is due not so much to a lag in the emptying of the duodenum as to unusual promptness in emptying of the stomach.

Pressure pain points. A definite pressure pain point corresponding to the position of the duodenum is often noted during the fluoroscopic examination. The pain point is often seen to definitely coincide with the shadow of the duodenum. It is not, however, pathognomonic of duodenal ulcer. The writer has often seen it in connection with periduodenal adhesions without any evidence (even at operation) of duodenal ulcer. There have been a number of cases, however, in which, in spite of tenderness over the duodenal and gall-bladder shadow, nothing could be found wrong with either of these organs. The writer is satisfied that there is considerable value, however, in palpation over the gastric shadow to localize the points of pain on pressure, but this pressure pain point is not likely to correspond to the location of the ulcer, unless there has been periduodenal or perigastric involvement with adhesions.

In the foregoing paragraphs I have only attempted to summarize and correlate the X-ray evidences which contribute to the diagnosis of gastric or duodenal ulcer. I would like to go on record as stating that in the present stage of development we are not justified in believing that the röntgen method of gastric examination constitutes a reliable method of detecting early gastric or duodenal ulcer. Nevertheless, I believe that in general it is true that surgical lesions of the stomach or duodenum cannot exist without some of the foregoing signs being present. I wish to state that I have seen a few well-marked gastric and duodenal ulcers at operation or autopsy where, during the X-ray examination, there was nothing found either fluoroscopically or röntgenographically which could be considered as suggestive of anything but the normal. It is an astonishing thing how often the bismuth meal will reveal most astounding conditions when they are least expected, and, on the other hand, it may be repeated, very often the X-ray findings are quite the ordinary, even in cases of gastric or duodenal ulcer, when from the clinical study of the case it was expected that the X-ray evidence would be especially characteristic.

DEPARTMENT OF TECHNIQUE

TREATMENT OF FRACTURES BY MEDULLARY BONE SPLINTS[1]

By CHARLES DAVISON, M. D., Chicago
Professor Surgery, University of Illinois; Attending Surgeon, University Hospital and Cook County Hospita

THE teaching of Mr. Lane has made the open operation for the treatment of simple fractures very popular and successful. The accurate reduction and stable fixation of fractured bones by metal plates fastened by screws is attractive. But the metal plates and screws are foreign bodies and their presence is more or less resented by the tissues.

In a small portion of the cases plated, the material inserted causes symptoms requiring removal as a foreign body. If the foreign body proposition could be eliminated from the open treatment of simple fractures it would be a distinct advantage towards good end-results.

When a simple fracture is held in fair position by external splints, one of the early efforts of nature to remedy the defect is the production of an internal callus, or medullary plug—a plug of new bone-making material, placed in the medulla across the point of fracture.

This plug ossifies and aids in the repair and support of the fracture; it becomes a medullary

Fig. 1. Case 1. Skiagram of left tibia immediately after injury.

Fig. 2. Case 1. Skiagram of tibia in plaster cast after attempted reduction, showing the impaction of the fragments of the fibula which prevented reduction.

[1] Read before the Chicago Surgical Society, February 6, 1914.

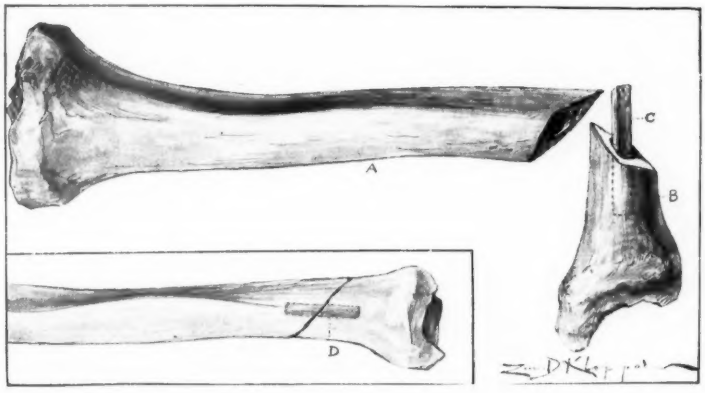


Fig. 3. Diagram of insertion of medullary bone splint.

Fig. 4. Case 1. Skiagram anterioposterior view, after insertion of medullary bone splint in the tibia.

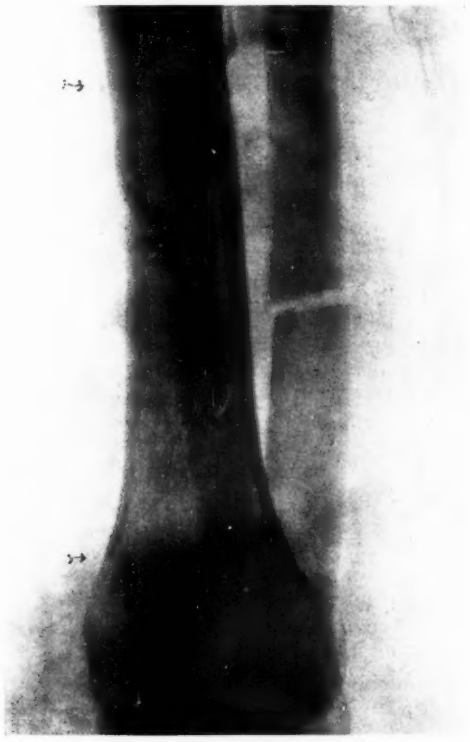


Fig. 5. Case 1. Skiagram lateral view.

Fig. 6. Case 2. Skiagram spiral fracture of left humerus slightly comminuted.

Fig. 7. Case 2. Skiagram of the humerus after insertion of medullary bone splint.

bone splint and remains as long as its support is required by the injured bone, and then the superfluous part is gradually absorbed and the medullary canal reëstablished.

In the cases reported, bone material was taken from the opposite tibia and placed in the medullary canal at the point of fracture, doweling the fragments together in a substantial manner.

Homogeneous living bone from the same individual is treated kindly by the tissues, and no matter whether it grows in and becomes a part of the bone, or whether it acts as a scaffold for new bone-cells, or whether it eventually is absorbed in whole or in part, it will be treated kindly by the tissues and will retain its integrity as a splint long enough for repair of the fracture to take place.

CASE 1. L. K., fracture of both bones, left leg. American, laborer, 33 years old. Alcoholic, specific. Slipped on the ice and fell, breaking his leg; admitted to Cook County Hospital at once, January 10, 1914 (Fig. 1).

Delirium tremens — treatment in fracture box one week. Attempted reduction, plaster cast, position unchanged (Fig. 2). Open operation with insertion of medullary bone split, January 24, 1914.

Incision over fracture showed a spiral fracture of tibia with three-fourths inch shortening, irreducible by traction on the foot and manipulation with levers at the fracture, on account of the impaction and entanglement of the fragments of the high-up fracture of the fibula. A transverse chisel fracture of the fibula was made from the outside which permitted reduction of the tibia.

A piece of bone three inches long and one-half inch in thickness in each direction was removed from the opposite tibia, without its periosteum, to serve as a medullary splint for the fractured tibia.

The part of the leg below the fracture of the tibia was turned at a right angle to the leg and the bone splint was driven into the medulla of the lower fragment of the tibia with a lead hammer sufficiently deep to make the splint firm and solid.

The medulla of the upper fragment was cleaned out with a sharp bone spoon to receive the upper end of the bone splint (Fig. 3).

The part of the leg below the fracture, placed at an angle to the axis of the leg with the end of the bone splint protruding from the medulla of the tibia, was manipulated so as to enter the end of the bone splint into the medulla of the upper fragment of the tibia and swung into proper position.

The muscles immediately retracted and held the fractured end firmly in position (Figs. 4 and 5).

The bone splint was fitted solidly into the medulla of the lower fragment, but loosely into the medulla of the upper fragment.

It was necessary to have the cavity in the upper fragment slightly larger than the bone splint, because it could not enter the medulla in a straight line, but must enter in the arc of a circle, the radius of which was equal to the length of the projecting bone peg and the portion of the lower fragment of the tibia which projected above the soft parts, during the manipulation of swinging the lower fragment into position.

CASE 2. O. S., fracture of left humerus. American, clerk, 37 years of age. Fell from porch while intoxicated, breaking his left arm; admitted to Cook County Hospital at once; mobility and angular deformity in upper third of humerus with one inch shortening. Attempted reduction and immobilization with moulded plaster splint (Fig. 6).

Open operation with insertion of medullary bone splint. Incision over fracture showed a spiral fracture of humerus three inches in length, overriding one inch.

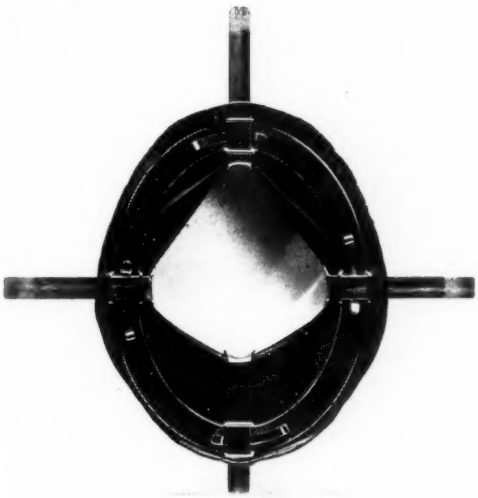
A piece of bone without periosteum, five inches long and one-half inch in thickness in each direction, was removed from the tibia and inserted into the medulla of the humerus at the fracture (Fig. 7).

A NEW SELF-RETAINING ABDOMINAL RETRACTOR AND WOUND PROTECTOR

BY U. C. BATES, M. D., SEATTLE, WASHINGTON

THIS retractor consists of an oval frame eight inches wide and nine inches long. To this are fitted four retractor blades that work through slots in the frame. These are held in any degree of retraction desired by a ratchet device which may be released by pressing a button on each blade. These blades work through a funnel-shaped piece of rubber so that when the retractor is in place the margins of the incision, as well as the field of the abdomen covered by the rubber, are completely protected from septic material from within or without. This also obviates the use of towels applied to the margin of the skin incision.

By means of this retractor any degree of retraction in any direction required may be obtained, thereby exposing any quadrant of the operative field desired. It enables the operator to get a larger field through a smaller incision. By reason of its self-retaining properties the abdominal wall can be raised which materially assists in introducing the packing gauze used to cofferdam the intestines from the field. After the packing gauze is in place it is retained there by the tension of the abdominal wall and the upper blade of the retractor. The rubber stretching from one blade to another makes retraction over the whole circumference of the wound, thus preventing pressure and traumatism by the blades, and the pressure of the rubber prevents any oozing from the wound surface.



Retractor partly open.

PRESENT STATUS OF JOINT DISEASES AND BEST METHOD OF TREATMENT[1]

By EMIL G. BECK, M. D., Chicago

I WISH to briefly review the latest advances in the etiology, diagnosis, and treatment of the acute forms of joint infections, laying a great deal of stress on vaccine therapy. Also to consider the more chronic forms as follows:

A joint disease is, in practically all cases, a secondary infection, except in cases of direct injury. Whatever type of microörganism it is, it is liable to reach the joint through circulation. There are three forms of joint affections which we meet most commonly:

First. Those of pyogenic origin.

Second. Tuberculous origin.

Third. Syphilitic origin.

Further, the very chronic polyarthritic diseases, the etiology of which is not yet fully known. By some they are thought to be a most chronic type of infection of the joint and the para-articular tissues, and again by others as nutritional changes which tend to the deposition of salts in the joints and ligaments.

The first step in the treatment is a correct diagnosis. I need not mention all the aids we have at our command, but I shall speak of the aid of the stereoscopic radiograph in making a differential diagnosis. I have made an extensive investigation of this method for several years, and have concluded that I am able to make, with exactness, a differential diagnosis and ascertain the progress of the disease, with this method.

I emphasize that the radiograph must be stereoscopic, otherwise the finer differential points are lost. The stereoscope produces a concrete picture of the fine details of the diseased structure, which brings out the differential points. A single picture is, so to speak, out of focus, and gives only the rougher points, which will confuse even the best diagnostician.

Before the era of Pasteur's discoveries the mortality of surgical treatment was most frightful, and the surgeons, discouraged, hesitated to operate. According to Follin's figures, the mortality at that time, due to operations of hip or spinal caries, was 56 per cent to 70 per cent, and now, after half a century of diligent study, work and discussions, surgeons have, to a certain extent, practically agreed on a treatment for surgical joint affection.

When, in spite of all efforts to check the progress of the disease, it still progresses, we are faced with a proposition the solving of which surgeons are not yet agreed upon.

The surgeon who can correctly solve this problem will save many lives and reduce the big army of cripples. It is the treatment of cold abscess to which I refer. The attitude of the physician toward the treatment of this condition is of the most vital importance to the life of the patient. Too many physicians still believe that a fluctuating cold abscess should be opened and drained by a rubber tube. This procedure is more dangerous than most any disregard for surgical asepsis. Calot says: "The physician who opens a cold abscess and drains it with a tube opens the door through which death nearly always enters."

What then would be the proper procedure? Should we wait until it ruptures spontaneously? *No.* It should be treated by puncturing with a trocar, allowing some of the fluid to escape, and then be injected with a modifying substance, such as Calot's mixture, formalin or bismuth paste, etc. In the past six years I have used bismuth paste (10 parts bismuth subnitrate and 90 parts yellow vaseline). All these methods are fully described in textbooks.

If, in spite of this procedure, secondary infection should take place and a chronic suppuration persist, then I recommend the injection of bismuth paste.

It is now about eight years since this method was introduced into surgery and it has, from the beginning, had many adherents, and has been tried not only in hospitals and clinics here and abroad, but has been used very extensively by country practitioners.

Some authors have obtained better results than we have, others have been only partially successful, and in the hands of a few the method has been a failure.

If we take into account, however, that we have to deal with a class of cases which have already been treated surgically and otherwise, without success, we must regard even the smallest percentage of cures as an actual gain. The analysis of reports from all sources, however, indicates that on an average of more than fifty per cent of these apparently hopeless cases were finally cured by these injections.

You are familiar with such cases. They con-

[1] Read before the Chicago Surgical Society, February 1914. (See discussion p. 774.)

stitute the scum of surgical refuse, cases in which every sect of medicine and surgery, and even quackery, have had a chance. Two of this class of cases in our series had lasted forty years, and many had had from ten to fifteen surgical operations.

My purpose is not to show what results I personally can obtain with this method. After all, you are interested in what you yourselves might accomplish, and, therefore, instead of citing percentages of cures, I shall select a few cases for illustration.

Are there other methods in vogue which will compare in their final results with this method? There are.

First. Heliotherapy, as carried out in Switzerland by Dr. Rollier.

Second. X-ray treatment systematically applied.

Third. Vaccine treatment.

Fourth. Surgical treatment, either conservative or active.

Let us compare the results which have been obtained with these different methods, taking for comparison from the literature reports made by the men who advocate these various methods.

HELIOTHERAPY

Dr. A. Rollier makes a complete report of 1,129 cases treated by sunlight in Leysin, a period of ten years from 1903 to 1913. Of the 1,129 cases, 445 cases were of joints and 198 cases of spondylitis which properly belong to joint disease.

Coxitis	158
Gonitis	120
Foot	94
Shoulder	12
Elbow	30
Hand	21
Polyarthritis	10
Spondylitis	198
Total	643

Of this number, 343 were closed tuberculosis without abscesses, 151 closed tuberculosis with abscess formation, 149 open tuberculosis with existing sinuses.

Of 343 cases of closed tubercle bacilli joints, 311 were cured, 28 were improved, 3 were not improved and 1 died. Mortality not ⅓ per cent.

Of 151 cases in which abscesses formed, 134 were cured, 10 were improved, 5 were not improved, 2 died. Total, 151; 1½ per cent mortality.

Of 149 cases with sinuses, 106 were cured, 24 were improved, 8 were not improved, 11 died. Total, 149; 7 per cent mortality.

Since Dr. Rollier does not resort to surgical procedure, but relies upon the curative effect of sunlight alone, we already have a proof that treatment without surgical intervention may produce very excellent results. His observations, experiments and theories as to the *modus operandi* of sunlight treatment are very instructive, but I cannot here go into their details.

THE RONTGEN THERAPY IN JOINT AFFECTIONS

B. Baish, of Heidelberg clinic, reviews the subject and gives the report of his own results.

The last reports of Dr. Iselin were so favorable that they gave a new impetus for trial in many clinics abroad, but no one could produce such results as Iselin reported. This may not be Iselin's fault, but that of other operators.

Baish treated 80 cases of joint tuberculosis, five of which were operated and 18 still being treated, leaving 57 cases in which treatment with X-ray has been completed. Results were as follows: 30 were cured, 17 were improved and 1 died, 10 were not improved and 3 died. Total, 57.

Most of these cases were in the late stages with sinuses, and thus with the X-ray treatment alone a cure of 30 cases out of 57 has been produced—a most remarkable showing of what X-ray alone can do in these progressed cases.

Baish states, however, that in some of these cases they had applied the bismuth paste, and some of his illustrations show that it had been used. Therefore, in these cases the objection could be raised as to whether the X-ray alone was responsible for the cure, since we have cases of this kind on record which have been cured by bismuth injections alone without the application of X-ray.

He cites that Schede has recommended that the cases be treated with radiation, and on the fifth day after the first application they should be injected with the bismuth paste, and in that way the best results could be obtained.

We now come to the consideration of the purely surgical treatment, and here I can do no better than cite the report of Professor Garre, made before the last Congress of the German surgeons in Berlin.

The report comprises material from the clinics of Rostock, Koenigsberg, Breslau and Bonn, covering a period of nineteen years' work, a collection of one thousand cases, which were treated at these different clinics under his own supervision.

He reports 261 cases of tubercular coxitis. Of these they could trace only 168, and 102 of this 168 were still alive, 62 having died—a mortality of 37 per cent.

Of the 168 cases, 71 were cases of closed tuberculosis without abscess. Eight were treated by resection with two deaths, a mortality of 25 per cent. Sixty were treated conservatively with 17 deaths, being a mortality of 28 per cent.

Fifty-nine cases had abscesses, of which 23 had resections with 13 deaths, a mortality of 56 per cent.

The remaining 31 cases had fistulæ, 16 of which were treated by resection, of which 5 died, being a mortality of 31 per cent. Twelve cases were treated conservatively, with 3 deaths, making a mortality of 25 per cent.

They have treated 454 cases of knee-joint tuberculosis, 268 of which were resected. They have cured 88 per cent, improved 5½ per cent, recurrence 1 per cent, amputation 3¾ per cent, deaths 2¼ per cent.

Two hundred and twenty-two ankle cases were treated, 80 of which were resected, with excellent results in 24 cases (30 per cent); good results in 25 cases (31 per cent); passable results in 10 cases (12½ per cent); not good results in 10 cases (12½ per cent) and 6 deaths (6½ per cent). On two cases there was no report.

Of cases of tuberculosis of the shoulder they treated 25, 8 being treated conservatively and 17 surgically, 12 of the latter being resected and 5 excochleated. Of the 8 treated conservatively, 1 left hospital, 4 got better, 1 had to be resected later and 1 got better much later.

Of the 12 resected, 8 cases were cured, 3 improved, and 1 not improved and subsequently died.

Of tuberculosis of the elbow, 79 cases were treated: 17 conservatively, 2 cured, 14 improved, 1 not improved; 19 excochleated, 5 of which were cured, 7 improved but fistulæ formed, and 7 not improved; 38 were resected, with a result of 25 cured, 10 not improved, and 3 died of general tuberculosis; 4 had amputations and were cured; 1 case an arthrectomy was performed with improvement as a result.

Forty cases of tuberculosis of the wrist were treated. Of the 13 treated conservatively, 9 healed and 4 did not; of the 14 excochleated 10 were cured, 3 improved, 1 not improved; 2 extirpation of tendon, both cured; 5 were partly resected with 3 improvements and 2 subsequent amputations; 1 complete resection with cure; and 5 cases were amputated with cure as a result.

The great mortality which surgical treatment produced would of course discourage anyone from bringing it into comparison with the conservative methods, but to be just, in making comparisons, we must consider that the present surgical methods do not produce the same mortality as they did nineteen years ago, in which period Professor Garre's cases date. Nevertheless the mortality is so much greater that, even in the hands of the very best men, like Professor Garre, results are not to be compared with those of the conservative methods.

I regret that I am unable to give full statistics of my own cases, treated during the past six years. To prepare such report would require several months' tracing of the patients, but it comprises a series of 650 cases of tubercular joints, at least ¾ being in the latest stages in which abscesses or sinuses have formed.

Thus we dispose of a material of the suppurative type much larger in volume that that of Dr. Rollier or Professor Garre, and useful comparisons can be made only by comparing the same types of cases, namely, those in the late stages. The average percentage of cures in our series was 72 per cent with a mortality of only 3 per cent, the remainder of the cases being either improved or unchanged.

Thus it is evident that the conservative methods of treatment are far preferable to the aggressive surgical procedures, but we regret to say that as long as the poor classes of people cannot avail themselves of such protracted treatment as is carried out at Leysin, the active surgical procedures will have to be resorted to.

X-RAY FINDINGS IN THE NORMAL STOMACH[1]

By ADOLPH HARTUNG, M. D., Chicago

RÖNTGENOLOGY has rendered possible examination of the human stomach in the living individual under ordinary conditions and herein lies its greatest value as an aid to diagnosis. But the information thus obtained has forced us to change many of our conceptions of that organ which were based on less accurate clinical methods of examination, and the findings on the operation and post-mortem table where conditions were entirely different.

Before considering the stomach itself, I shall briefly describe the technique employed in the röntgen examination. To render the stomach visible by the ray, a meal is given consisting of about 350 grams of some palatable media such as gruel or fermented milk containing about 50 grams of bismuth oxychloride or 100 grams barium sulphate, either of which are practically inert and tasteless. The little additional specific gravity they induce is negligible for practical purposes as has been proven experimentally. This should be given on an empty stomach, and if marked constipation has been present it may be well to precede it by a cathartic, otherwise not, for our aim is always to approximate ordinary conditions as closely as possible. The shadow of this meal in the distended or moderately contracted stomach gives us a fairly accurate representation of the stomach itself.

As to the methods employed, several are in use. The röntgenoscopic consists in placing the patient before the fluorescent screen and directly observing the filling of the stomach, its contractions, and its emptying. This may be supplemented by palpation with the gloved hand or specially constructed palparium. With the protective devices now in use, such an examination can be made with practically no danger to the patient or operator. This method, although the simplest, is also the most difficult for it necessitates an eye which has been trained to see quickly and accurately moving shadows which to the occasional observer are exceedingly dim, indistinct, and meaningless. The röntgenographic method, on the other hand, gives more clearly defined pictures of the stomach at any one instant, and if enough negatives are made, as in the serial method advanced by Cole, of New York, practically all the phases of contraction can be studied in detail at one's leisure. The patient ought to be examined in different positions to get all the information available. A combination of the two methods is undoubtedly the best procedure. A third method, the cinematagraphic, as first shown by Kaestle-Rieder-Rosenthal, combines many of the advantages of the other two but owing to the big expense it involves it is hardly practicable.

To describe the normal of an organ of which it has been said that the only constant thing about it is its changeableness is exceedingly difficult. When empty it is contracted so that its walls lie in contact except near its cardiac end where they are slightly separated by an air bubble—the so-called "Magenblase." The full stomach, as seen with the aid of the röntgen ray, in no wise resembles the type we ordinarily see pictured in our textbooks on anatomy, and which was first described by Luschka in 1873. This is what Forsell calls the passive type of stomach and can be approximated by our distending the organ with gas when the tonus of its musculature is overcome and we have a record only of its fibrous and elastic elements as represented by its submucosa. The anatomic shape of the stomach in the living is determined largely by its musculature and it is this shape we see with the aid of the röntgen ray. As long ago as 1881, Lesshaft, before the medical congress in London, said, "The stomach is usually vertical, its fundus touching the diaphragm, its lesser curvature to the right, its greater to the left and downward; the antrum pyloryi turns up and to the right (occasionally backward) as it connects with the duodenum." This practically corresponds to our röntgen ray experience. Fully 80–90 per cent of the normal stomachs conform to this type when examined in the upright position. This is the so-called fish-hook type of Riedel or siphon form of Groedel. The other 10–20 per cent belong to the cowhorn type of Holzknecht, the pylorus forming the lowest point, the stomach gradually tapering down to this point obliquely from the left above to the right in about the median line. In the horizontal position the shape of the stomach is extremely variable, depending on decubitus, pressure, and location. Schlesinger has divided stomachs into four types depending on the tonus of its musculature: (1) the hypertonic or cowhorn, (2) the orthotonic or fish-hook, (3) hypotonic where the greater and lesser curvature are approximated more than usual and the caudal end somewhat enlarged, and (4) the atonic, an exaggerated form

[1] Read before the Chicago Surgical Society, December 5, 1913. (See discussion, p. 771.)

of the hypotonic. The shape of the individual has much to do with the shape of his stomach, a broad abdomen with wide intercostal angle predisposing to the cowhorn type and a long narrow abdomen to the vertical type. Other factors which may cause variations in shape of the normal stomach are respiratory movements, overdistention of the colon with gas or fæces, tumors or displacements of other organs, and changed contours due to clothing, such as corsets.

The position of the filled stomach depends largely on the position assumed. In the upright its greater portion lies on the left side, the pylorus being located just to the right of the median line. In the horizontal posture it usually extends farther to the right. In males it occupies a little more oblique position than in females. Its size and shape also markedly influence location. There are practically no normal limits clearly definable, for many stomachs producing no symptoms whatever, are found to extend considerably below the umbilicus.

As regards size, this too varies within wide limits. Ordinarily we do not try to distend the stomach to its utmost. Most of our examinations are made with a fairly definite amount (400 grams) of the opaque meal. In the normal the stomach walls adapt themselves around this by virtue of their tonus or so-called peristole. If a greater amount is given, the stomach increases uniformly as long as its tonus is intact. Beyond that point we get the volume of the passive stomach which may vary from 1000 to 2000 ccm. or more.

So much for the stomach at rest. But before passing on to the actively contracting stomach, I wish to call attention to the conflicting nomenclature in use as applied to the different parts of the stomach. Some of the anatomists and röntgenologists divide the stomach arbitrarily into parts as was done by Luschka long ago. More recently an attempt has been made to divide it on anatomic and biologic lines notably by His, Jonnesco, and Forsell. The last named author divides the stomach into a digestory sac and egestory canal. The former he subdivides into three parts: 1. The fornix ventriculi, which constitutes approximately the upper one-third, and is limited by the upper segment loop of muscles, is occupied largely by the "Magenblase" in the filled stomach, and has little or no peristaltic movement. 2. The corpus ventriculi which extends to the level of the bend, and is limited below by the lower segment group of muscles. 3. The sinus ventriculi, the "Magensack" of other authors, occupies the caudal pole between the corpus and egestory canal, and serves as a reservoir for the food before it is emptied into the duodenum. The egestory canal is that portion of the stomach beyond the bend. It is marked proximally by a deep ring contraction (often referred to as a sphincter), extending from the incisura at the angle of the lesser curvature to a shallow sulcus directly underneath. The pylorus forms its other boundary. It is the part commonly referred to as the antrum, and is the most active in forcing the food out of the stomach.

Now, then, as regards the stomach in action: If the filling process is watched, the food, after it passes through the cardia, drops to the bottom of the air sack, the collapsed stomach walls gradually open like a funnel, and the food slowly passes to the caudal end of the stomach. The first mouthfuls seem to follow in groove arrangements along the lesser curvature, called the "Magenstrasse" by the Germans. As more food is taken the greater curvature gradually moves away from the lesser, and the characteristic stomach shape is produced. When the stomach is filled, various types of movement can be observed. Groedel divides these into rhythmic and arhythmic contractions. The rhythmic may be so shallow as to be scarcely visible, but as digestion proceeds, or if the stomach is stimulated as by pressure against the screen, they become more forcible. Their function is to thoroughly mix the contents. The waves start at about the junction of the fornix and corpus as shallow depressions, and become gradually deeper toward the pylorus. At the beginning of the antrum they at times almost completely shut off the lumen, and move toward the pylorus as a concentric ring, forcing the contents through the pylorus if it be open or allowing them to return into the stomach, if not. Often a second or third wave starts before the first has reached the pylorus. The time necessary for a wave to travel from its starting point to the pylorus varies from eighteen to twenty-eight seconds: it traverses the length of the antrum in about eight seconds.

The arhythmic contractions are very small ones, seen along the walls of the greater curvature of the corpus only, and are believed to have to do with digestion itself. Forsell thinks they may be movements of the rugæ, induced by the muscularis mucosa. If the stomach contents are markedly acid the peristaltic waves are usually deeper and more forcible. The stomach contents, as they are forced through the pylorus into the first portion of the duodenum, usually assume a regular triangular shape, called the caput or cap.

As the stomach becomes empty and hence becomes more permeable to the ray, rugæ or folds can frequently be seen. The same picture can often be produced by pressure when the stomach is filled.

As regards the emptying time of the normal stomach, much depends on the type under consideration. The hypertonic type can readily empty itself in two hours, the orthotonic in four, the hypotonic in six, and the atonic in eight. Six hours is usually considered the limit of the normal. One precaution is necessary in determining this, that the patient take no food or drink after the original meal, until after the examination for motility has been made.

Close attention to the variations in the normal will often obviate faulty interpretation of the apparently abnormal.

VARICOCELE OPERATIONS

By WELLER VAN HOOK, A. B., M. D., Chicago

THE enlargements of the veins of the spermatic cord are so common among young men that they are met with by every practitioner of medicine. They require no further treatment, in the majority of cases, than the use of a suspensory bandage. But if this is used it must be selected and applied with care.

Operations are indicated only where great discomfort resists treatment by support, or where the testis shows signs of incipient atrophy.

The standard and typical operation is that of the partial excision of the veins of the cord. The shortening of the scrotum by excision of the dependent part is an occasional requirement, indicated only in cases where there is extraordinary laxity.

Shortening the scrotum is often done in a haggling, unsurgical manner which is unnecessary if one understands the difficulties and knows how to avoid them.

The skin is not the only structure which supports the contents of the scrotum. They are upheld chiefly by the dartos and the spermatic cord. Furthermore, the peculiar structure of the skin must be remembered: it contains a large amount of unstriated muscle tissue. When the scrotum is shortened with scissors great changes in its form and the relations of its walls occur. This is due largely to the contraction of the involuntary muscles and of the connective tissues.

Hence transection of the skin is at once followed by violent and very irregular contraction of the various structures. Much bleeding occurs and, worst of all, some of the vessels, especially the numerous dilated veins, are likely to cease bleeding under pressure and coagulation only to begin bleeding some hours later. The writer has had this most embarrassing experience.

To overcome these difficulties he now operates as follows:

Draw the redundant part of the scrotum through the varicocele clamp with care as to the following details:

1. The clamp must lie in the median anteroposterior plane in order that the incision-scar may be continous with the scrotal raphé. This incision leaves the scrotal walls well supplied with blood-vessels.

2. Apply the extra support in the middle of the clamp.

3. See that the clamp is so firmly and evenly adjusted that all tissues are compressed alike, but not excessively.

The clamp (Fig. 1.) he uses was especially designed by him. It is heavier than the common clamp and better made. Its shape gives it special advantages in power and in adjustment. The scrotum is so lax that it can easily be drawn through the clamp to the production of any desired shape of stump. It will be understood at once that the more the tissues are drawn through near the ends of the incision the more sharply will the wound curve back toward the body.

Even this powerful clamp springs at mid-point when under heavy pressure. Hence a reinforcement was provided in the screw pressure clamp indicated.

Now, having applied the clamp, cut away with strong scissors the redundant tissues leaving at least one-eighth of an inch of tissue beyond the jaws of the clamp. Next insert silkworm gut stitches through the suture openings in the clamp, using straight Hagedorn needle. The clamp as designed by the writer has such suture-openings as will easily "take" the threaded

needle. The sutures are to be tied immediately upon introduction and they must be drawn firmly to prevent hæmorrhage.

When all sutures are tied the clamp is removed and any needed intermediate sutures are applied. The wound must not be dressed until all hæmorrhage has been arrested. But no trouble is likely to occur if the clamp is carefully applied and the sutures accurately placed.

The sutures must be left until they can be seen to be no longer acting as supports.

Excision of some of the veins of the cord is usually all that is needed to overcome the difficulties of severe though not extreme cases of varicocele.

This operation, also, can be much simplified by the following method:

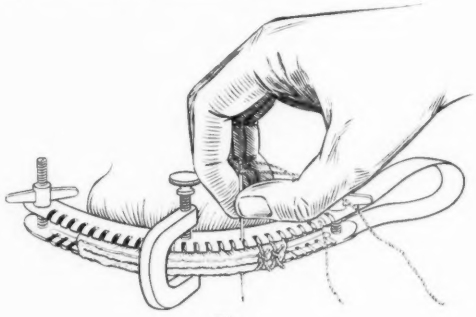


Fig. 1.

Make an incision between three-quarters of an inch and one inch long, passing through the skin and dartos (Fig. 2). This is facilitated by lifting the entire cord, holding it up against the skin in front of the forefinger and thumb of the left hand. Now the various connective-tissue layers are incised by quick, light touches of a small, very sharp knife, until the vein walls roll out free.

The connective tissues need not be individually recognized or studied. Look only for the veins and quickly expose them. Next pull out the veins sharply; find the vas deferens by touch—it feels like a small hard whip-cord. Having found it push it toward the scrotum with one vein. The remaining mass of veins is to be excised.

Pull out the veins by drawing towards the testis and then toward the inguinal canal till no more vein tissue slips out and tension is strong. Tie carefully and strongly each side of the loop with tested catgut leaving long one of each of the ligature ends. Cut out the loop of veins and tie together the ends of catgut that were left long. This at once removes the redundancy of vein tissue, restores the continuity

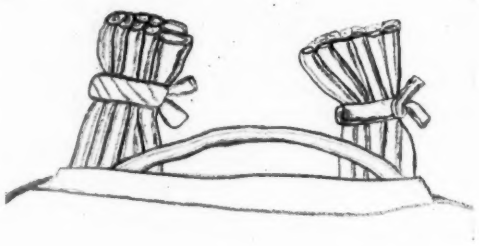


Fig. 2.

of the spermatic cord and raises the testis to its normal position. In the great majority of cases the scrotum retracts to support the testes in a satisfactory manner and the incipient atrophy is arrested. But a testis that has once lost something of size or consistency is not likely wholly to regain the normal state.

The small incision in the skin may be closed, after dropping into the scrotum the united stump of the cord without paying any attention to the fascial structures, the small wounds in which give rise to no disturbance. Four or five silk-

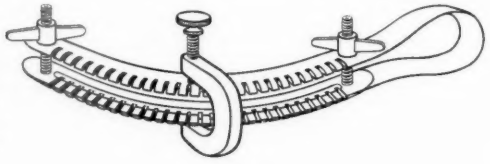


Fig. 3.

worm stitches suffice. Care is to be taken that the wound is well supported for about ten days lest its edges separate under the action of the muscular and connective tissues of the scrotum wall. A suspensory bandage should be worn if pain is experienced. But this soon ceases to be needed.

A CLAMP INTENDED TO FACILITATE THE SUTURE-ANASTOMOSIS OF HOLLOW VISCERA

By WILLARD BARTLETT, A. M., M. D., Saint Louis

At the present time most operators of experience in stomach and intestinal work find it convenient or even necessary, in making an anastomosis, to employ an instrument which subserves three purposes; viz., (a) holds the viscera fixed in a desired position, (b) prevents the escape of contents, (c) produces hæmostasis.

When the need of some such appliance first became apparent, the surgeon chose quite naturally the Doyen elastic pedicle forceps, this being more nearly applicable than anything else found in the ordinary hospitable armamentarium.

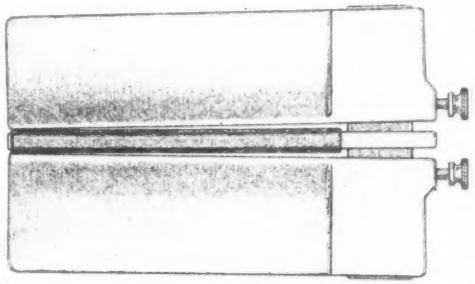
It does seem surprising, however, that this simple instrument or modifications of it should have continued so long in this use, when its obvious disadvantages are considered. It cannot exert an even pressure along the full extent of its blades, as is readily seen when its structure is taken into account. Near the "joint" a crushing force is exerted, while between the free ends may be had just the desired compression and at the same time the viscus be slipping back at a point midway between these two extremes. At best, the operator has very little idea of just how much force is applied at any given point since it is indirectly exerted in the manner of a lever acting on a fulcrum. Furthermore, the pressure cannot be delicately graduated on account of the distance intervening between the catches.

The accompanying drawing gives the details of an instrument which I have employed since June, 1913. Its broad flanges are five inches (twelve and one-half cm.) long by one and three-quarter inches (four and one-half cm.) broad, being ample for any purpose and still never too large as shown by the fact that I have employed them in making an anastomosis on a small dog. The entire apparatus is cast in aluminum, hence is surprisingly light, when its size is considered.

It is used in a gastro-enterostomy as follows: The bowel is compressed by the thumb and fingers of one hand directly forcing the middle blade and one lateral blade together upon it, while the other hand tightens a set screw; this maneuver then is repeated with the stomach on the other side of the instrument.

As is shown in the cut, the lateral flanges are swung closer together at their free ends than at their bases by the set screws. This is necessary to prevent the viscera tending to slip out of their grasp.

A little practice will enable anyone to apply the contrivance easily and speedily, although this may not seem so the first time it is used by one accustomed to the elastic clamp only.



Bartlett's Anastomosis Clamp.

The following advantages may be fairly claimed for the contrivance:

1. It compresses the viscera evenly throughout its entire length.

2. The amount of compression is known, being directly applied and controlled by the surgeon's fingers.

3. The most delicate adjustment of the instrument is possible.

4. When locked in position it constitutes a thin metal plate about five inches (twelve and one-half cm.) by four inches (ten cm.) which effectually prevents protruding viscera and gauze packs from getting into the field of operation. It goes without saying that the probability of soiling is thereby lessened.

AMNIOTIC MEMBRANE FOR THE PREVENTION OF POST-OPERATIVE PERITONEAL ADHESIONS

A Preliminary Note

By C. B. LYMAN, M. D., Denver
Professor of Surgery, University of Colorado
AND
W. H. BERGTOLD, M. D., Denver
Attending Physician, Saint Joseph's Hospital

MANY abdominal operations result in adhesions, not because of faulty technique, but through the necessity of breaking up adhesions in existence prior to operation. Such separated adhesions usually recur promptly after operations, and it seems to us that this constitutes one of the weak points in abdominal surgery, because no method has been devised which will positively prevent such recurrence. It is also very desirable that some method be invented to prevent, primarily, the formation of peritoneal adhesions where the operative procedure unavoidably causes large areas of peritoneum to be denuded of endothelium. Obviously, what is needed is some method which will prevent organization of the plastic material that temporarily covers the raw peritoneum, and will keep such denuded surfaces apart long enough to permit complete endothelial resurfacing. It is probably true that such a device is needed only during the first forty-eight hours after operation, a period which is sufficient to allow complete repair of the denuded peritoneal surfaces.

It seems to us that, up to the present, all methods aiming to prevent peritoneal adhesions have been largely or wholly unsuccessful, except, of course, where the conditions permit of covering denuded areas by plastic operations, methods applicable, at best, to a very limited number of cases. The ideal procedure would seem to be the interposition between the denuded areas of some kind of thin animal membrane: it would have to be sterile, non-irritating, and capable of being absorbed, yet resistant to absorption for at least forty-eight hours after operation. Various tissues have been utilized for this purpose, mainly Cargile's membrane; this, however, is not to be obtained in very large pieces, which renders it more or less useless when one has to deal with extensive areas of denudation.

Many animal membranes have been considered by us, but all have been rejected, either as too difficult of absorption, too difficult to secure sterile, or too unyielding to be safe.

It finally occurred to one of us (Bergtold) that amniotic membrane might be suitable in every way for the purposes in mind. The following case history of a patient under the care of one of us (Lyman) describes the method of preparation and preservation of this membrane, the technique of its use, and the apparent result:

The patient, a woman of 25 years, had been operated upon for appendicitis some seven years previous to coming under observation here; she was operated by one of us (Lyman) for gastric ulcer two years ago, a posterior gastro-enterostomy and freeing of many adhesions being done. Following this operation she had symptoms which could be explained only by the existence of abundant recurring peritoneal adhesions in the upper part of the abdominal cavity, and in November last an operation was done for the purpose of correcting this condition. Very extensive adhesions were again found, adhesions which involved the liver, gall-bladder, duodenum, stomach and transverse colon. These were all freed, the raw surfaces smeared with sterile oil, and the abdomen closed. Within a week there was a return of all the symptoms which had existed prior to this last operation, and continued for five weeks, at the end of which time it was decided to again open the abdomen, and employ chorionic membrane to prevent new adhesion formation. This was done on December 20, 1913, when three sheets of chorionic membrane were used each about five inches square. One was interposed between the liver and gall-bladder, and the duodenum and stomach, the second was placed between the transverse colon and small intestines beneath the colon, and the third was placed under the abdominal incision, all three sheets being held in place by catgut stitches.

It is now more than five months since this last operation, and the patient has remained entirely free from the distressing symptoms which had previously been in existence for many months.

This membrane seems especially suitable for work of this nature, in view of the fact that it can be obtained in sheets of large size, that it is sterile to start with, that it is easily preserved and kept sterile, and that it is thin and probably easily absorbed.

The material (amniotic membrane having been selected by Lyman) used by us was obtained from a patient free from constitutional disease; it was prepared by washing in running water for two hours and then kept in one per cent lysol solution until needed. The one objection to it, so far as

we have had experience, is that it is slippery and friable when prepared by the method detailed above. We believe this objection can be overcome by placing the membrane in absolute alcohol for a few days, preserving it in 50 per cent alcohol, and washing it thoroughly in sterile, normal salt solution before using it.

We hope to publish the results of animal experiments designed to test the method.

This preliminary note is published in order that the method may receive early attention, and be subjected to test at the hands of our colleagues. It would seem to us, in so far as one can ever draw conclusions from one experience, that we are justified in feeling—

A. That this method is harmless.

B. That it does prevent the formation of peritoneal adhesions.

C. That it is easy of application.

D. That it is worthy of further trial.

NOTE.— Since the above was written, Lyman has employed this method in six other cases, in all of which the results have been eminently satisfactory, the preëxisting symptoms due to adhesions not having recurred up to date. Since the first operation we have been preserving the membrane in one-half per cent solution of formaldehyde in seventy per cent alcohol.

THE ELECTRIC DRILL, SAW, REAMER, AND TREPHINE IN BONE SURGERY [1]

BY CHARLES GEIGER, M. D., SAINT JOSEPH, MISSOURI

FOR some time those who are engaged in the practice of surgery have realized the necessity of modernizing the instruments and methods employed in operating upon the head and large bones. The old crude method of employing the chisel, hammer, and hand drill are unscientific procedures, requiring too much valuable time, and exhausting the patient.

In modern bone work it is absolutely necessary, in some cases, to remove bone-grafts varying from two to ten inches in length. The only correct method to do this is with the electric circular saw. In the latest treatment for Pott's disease, a bone graft is taken from the tibia of the individual suffering with this disease, the length of the graft depending upon the number of vertebræ that are diseased. The graft extends into at least one healthy spine of the vertebra, above and below the diseased member or members. In fractures that cannot be held in apposition by methods commonly used, and also in ununited fractures, in place of Lane plate, bone-grafts are used. The grafts are usually taken from the tibia. After the ends of the fractured bones have been reamed out with the electric reamer, the graft is inserted into the ends of the fractured bones. All bone-grafts must fit snugly, otherwise they are liable not to grow. The operator should always keep in mind the importance of preserving the periosteum on the graft, as the periosteum has much to do with the blood supply and with the life of the graft.

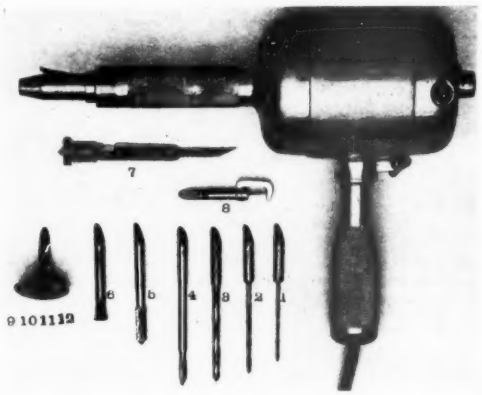
Eminent surgeons have found that handling, manipulating, and trauma are the causes of infection in bone grafting, operating on ununited fractures, or any plastic bone work, and the slightest infection is destructive and hazardous to good results. The above causes of infection are eliminated by the use of this set of instruments.

The object of this instrument or device is to supplant the cable, which usually conveys the power from the motor to the instrument; the cable has been used by all other motor bone sets. It is always in the way, and if bent at right angle, or at any acute angle, while it is running, it will generate heat, and its action be retarded. The Geiger device, motor and all, is held in the hands of the operator, and gives firmness and rigidity to the instrument on account of the weight and firmness with which it can be held. The operator, by a motion of his thumb, turns on or off the electricity without any effort, as it is always at his thumb's end.

Owing to the weight and firmness with which the instrument can be held, and the motor being under perfect control, the operator is absolute master of the situation, while using any one of the instruments, in the most delicate bone operation.

This instrument which I have devised comprises a one-fifteenth horse power, universal 110 volt motor. The housing is aluminum. The motor is wound with an enameled wire. The enameling is baked on with a temperature of 1000 degrees F., and all connections are insulated

[1] Read before the Academy of Surgery, Saint Joseph, Missouri, February 2, 1914.



with a special insulation (Bakalized fiber). The switch is made of dilecto. There is nothing about the motor that can burn or be melted with a temperature lower than 130 degrees C., which gives us an assurance that the motor can be thoroughly sterilized, with dry heat, without harm.

The speed of the motor is 7000 R. P. M., reduced with a double set of cogs to 400 R. P. M. The back gearing of the motor increases the torque at the instrument seventeen times, thereby giving all the power that is required. It has a handle and a hand piece which are cast integral with the housing of the motor. The hand piece gives firmness to the chuck. By reason of the construction, the operator has perfect control of the instrument.

The handle and hand piece are at right angles with each other. The hand piece is four inches long. At the outer end of the hand piece is a ball bearing which receives the outside thrust, or the inward thrust, of the instrument, so that any pressure brought to bear upon the instrument will not interfere with the power of the motor.

The chuck, which is a special one, is simple and effective, giving absolute rigidity and firmness to the instrument while in operation. The instruments are interchangeable in the universal chuck, and the instrument to be used by the operator can be quickly adjusted or released, as will be seen by a glance at the construction of the chuck. The motor, complete, weighs about four pounds.

Any surgeon who has had much experience with bone work appreciates the great difficulty of enlarging holes in bone with the ordinary hand reamer or chisel. In making holes for wiring bone, the electric drill is unsurpassed, as it penetrates without pressure.

The trephine found in this set is a new creation, and has no equal in efficiency. The guard and center pin are regulated by a thumb screw; the guard prevents the instrument from plunging into the cranial cavity. It can be set at any depth desired, by a simple movement of the finger.

In mastoid work it does away with the jarring and concussion caused by hammering, and prevents the possibility of puncturing or lacerating the coverings of the brain, not only in mastoid, but in other cranial work.

The electric saw will be found of great service in removing plaster casts, only one-tenth the time being required, as compared to the old method, and the operator is relieved of all work.

The cranial saw is simplicity itself, and is very effective in its work. It has a guard that dissects the dura from the skull, and at the same time protects the soft parts from being harmed by the saw. There is one special burr in the set (No. 5), which has a sharp point, and the cutters are cross-cut. This burr cuts with much more ease and much faster than the ordinary burrs.

The complete set consists of one motor, one sterilizer, two drills, two burrs, two saws, with mandrels, one trephine, and one cranial saw. The two saws that go with the set are both one and one-fourth inches in diameter, one having twice the set of the other.

This instrument was tried out by Dr. John B. Murphy of Chicago, during the Clinical Congress of the Surgeons of North America, November 13, 1913, and he stated as follows: "This is a first-class device, and by the use of this set of instruments—trephine, cranial saw, burr, and drills—we simplify and modernize bone surgery, also reducing the time and labor, both of which are essential factors in this important branch of work. The great power and efficiency of this small instrument, as a motor, saw, electric drill, reamer, and trephine, deserve the highest commendation of the profession."

ANÆSTHESIA IN SURGICAL RESEARCH

A Simple, Economical and Efficient Apparatus for Ordinary Routine Work

By BERNARD FRANCIS McGRATH, M. D., Mayo Clinic, Rochester, Minnesota

THE method herewith depicted and described contains nothing which is new in principle. It is presented for what it is worth, as a well tested, efficient, and comparatively inexpensive routine procedure. Anæsthesia is induced by means of a cabinet and continued with the apparatus shown in the figures. A rubber tracheal tube is attached to the horizontal limb of a three-way metal tube (Fig. 1). The latter contains within its lower limb an inlet valve, and an outlet valve within its upper limb. The former valve opens with inspiration to admit ether and closes with expiration; the latter closes with inspiration to exclude air and opens with expiration. The lower limb is enclosed in rubber tubing and inserted into the neck of a can of ether. A small opening is made in the top of the latter allowing a current through the ether vapor. In a side of the upright of the three-way tube is an opening for the admission of extra air. The amount of air is regulated by a perforated cuff. The three-way tube with its usual attachments may be sterilized. Some of the various combinations which may be effectively employed with the apparatus are shown in Figs. 2, 3 and 4.

Application. Under deep anæsthesia the jaws are separated, held apart with loops of strong tape, and the tongue is drawn forward with forceps. The laryngeal opening is made visible and easily accessible by means of gentle traction on a forceps lightly applied to the frænum of the

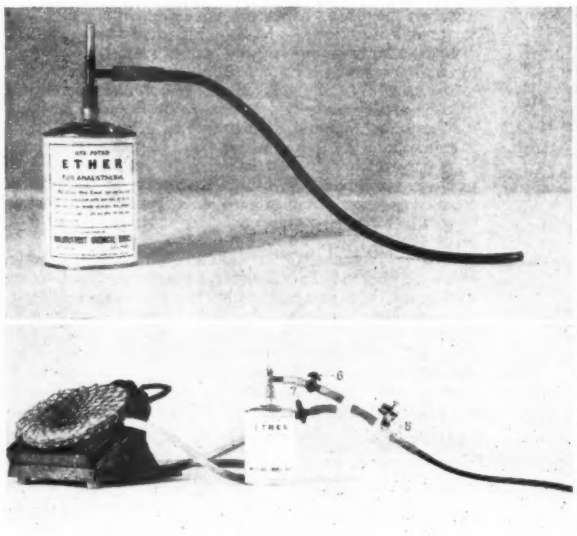


Fig. 1.
Fig. 3.

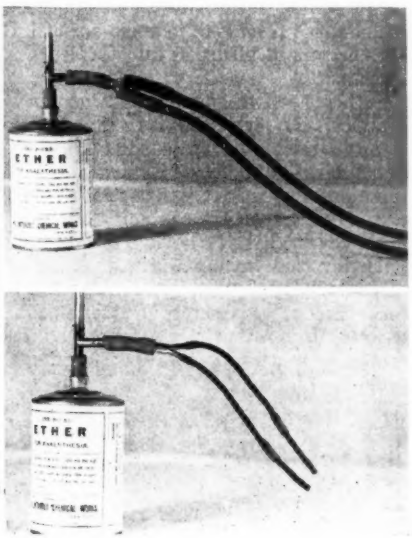


Fig. 2.
Fig. 4.

Fig. 1. (1) Location of *inlet* valve. (2) Location of *outlet* valve. (3) Opening and cuff for regulating extra air. (4) Tracheal tube.

Fig. 2. By removing the *inlet* valve and applying the arrangement shown in this figure, two animals can be anæsthetized with one apparatus. This has been successfully employed in twelve cases of transfusion.

Fig. 3. Foot bellows for insufflation, tube (5) for kymographic record of respirations, and regulating stopcocks (6 and 7) may be added to apparatus.

Fig. 4. Intranasal method. The mouth is closed to exclude air as far as possible, and absorbent cotton packed about the tubes in the nose. Commonly used before intratracheal method was adopted. The latter is preferable.

epiglottis. The tip of the tracheal tube is inserted into the opening of the larynx, the left index finger placed behind as a guide, and the tube now passed into the trachea.

The mouth is held closed with a piece of tape, and, if necessary, a small amount of absorbent cotton is placed in the anterior nares. There is usually sufficient space between two teeth for the tracheal tube. This apparatus has been used by the writer in more than two hundred cases. It is practically automatic, requiring but little attention, and, consequently, may be useful in the absence of adequate assistance or where equipment is limited.

PITUITRIN IN INTESTINAL PARESIS FOLLOWING ABDOMINAL OPERATIONS

By O. H. STANLEY, A. B., M. D., Concord, New Hampshire
Assistant at Margaret Pillsbury General Hospital

PITUITRIN has been extensively used, recommended, and its results reported in obstetric practice. I have searched for literature giving definite results of its use in cases of intestinal paresis following abdominal operations in which there has been extensive manipulation of the viscera. The manufacturers include this condition in their list of indications for the use of pituitrin but furnish no definite statistics.

It has been frequently observed in obstetric practice that soon after its administration there is often micturition and sometimes defecation, but there is difficulty in stating whether these functions are caused by the action of the pituitrin or the pressure of the oncoming head.

However, I have noticed bowel movements following the injection of pituitrin, after the placenta was delivered. My purpose in reporting these three cases is merely an attempt to stimulate reports from other physicians who have had greater opportunity to observe effects of the drug.

Case 1. Female, age 19. Operation, double salpingectomy. Many adhesions were found in the pelvis involving a considerable area of intestine. Thirty-six hours after the operation she developed intestinal obstruction. Again the abdomen was opened and the adhesions causing the obstruction were broken. Both operations required much manipulation of the gut. A few hours following the second operation the patient's belly became greatly distended and all methods of obtaining expulsion of gas failed. The rectal tube was passed, suds enemas, high saline enemas and enemas of molasses, milk, and turpentine were given without result. Physostigmine, hypodermatically, failed to help. Hot turpentine stupes were applied to the abdomen. At this stage one cc. of pituitrin was given hypodermatically and repeated every hour. Before the second injection the patient expelled a small amount of gas. After the second injection she had a large fæcal movement and expelled a large amount of gas. Treatment was continued for six hours. Patient made an uneventful recovery.

Case 2. Male, age 24. Operated upon for appendicitis. The appendix was buried in a mass of old adhesions and required much manipulation to free it. Ten hours following the operation the abdomen became greatly distended with gas which did not respond to enemas. One cc. of pituitrin was given and fifteen minutes later the patient expelled a large amount of gas. After the second injection there was a fæcal movement. Only three injections were necessary.

Case 3. Woman, age 45. Operated on for ventral hernia following abdominal section for an ovarian cyst. There were many adhesions of the intestine to the parietal peritoneum. Fourteen hours after operation the bowel became greatly distended and injections of pituitrin were begun. After the third injection the patient began to expell gas and had no further difficulty.

It is evident that one must be sure that the intestine is not obstructed by firm adhesions or other abnormal growths. For this reason, it is advisable to begin the administration of pituitrin soon after the operation before adhesions have had time to become firm.

TRANSACTIONS OF SOCIETIES

CHICAGO SURGICAL SOCIETY

A Regular Meeting was held December 5, 1913, with the President, Dr. M. L. Harris, in the Chair

Dr. Adolph Hartung read a paper by invitation entitled "X-ray Findings in the Normal Stomach." (See p. 760.)

Dr. Hollis E. Potter read a paper by invitation entitled "Mechanical Factors in the X-ray Diagnosis of Pathologic Conditions of the Stomach."

Dr. James T. Case read a paper by invitation entitled "The Röntgen Findings in Gastric and Duodenal Ulcer." (See p. 739.)

An invitation was extended to any visiting physician to take part in the discussion.

DISCUSSION

Dr. Charles Spencer Williamson: I have been very much interested in the remarks that have been made by the various speakers and from the standpoint of an internist I can hardly expect to add anything of interest to what has been said. We internists have had some experience with the X-ray and with X-ray experts, and there are one or two things which it may not be out of place to discuss here. First, I was interested in the emphasis that Dr. Hartung placed on the whole subject of rugæ produced by pressure. It would seem simple to comprehend that when the stomach is filled with bismuth it would be in such a position and relation to the backbone as to cause apparent stenosis, or that other peculiar phenomena should exist. This has led in two or three different cases to erroneous diagnoses, the X-ray operator having taken, as he supposed, ample pains to do away with these pressure signs, and yet for all that in some way the backbone pressed against the stomach and produced signs which were attributed to carcinoma, etc., and in two cases it actually led to a diagnosis of carcinoma, and operation for that condition was undertaken.

With reference to poses, I am very much interested in the subject of enteroptosis and I want to call attention to one thing that has led sometimes to the clinician being held in disrepute by his X-ray colleagues where, as a matter of fact, he did not deserve to be. These are cases in which the old-time methods of determining the position of the stomach were resorted to. The method, I take it, most frequently used, is inflation by a double bulb, with air. When you try to determine the location of a patient's stomach by the method of inflation you do not get a correct silhouette. Let us stop to think of the conditions when we pump up a patient's stomach with air. Naturally, it is fairly taut, and then, with the patient in the erect or recumbent position, we percuss it out. The stomach takes on a cylindrical form, and what we percuss out is, not the silhouette, but that part in contact with the abdominal wall. Now, the portion below which is and cannot be percussed out appears, when the stomach is filled with bismuth, two inches lower than when we percussed it out. On two or three occasions the internist has been held in disrepute in determining the position of the stomach when, as a matter of fact, a difference in the method of percussion is what led to the apparent discrepancy. From my standpoint, as an internist, I find the röntgen ray a great help in the diagnosis of gastro-intestinal, especially in lesions of the œsophagus, which have been dwelt on fully, and it is in these conditions that I think the X-ray does something which can be done in no other way as well.

Again, in adhesions between the duodenum and gall-bladder and in adhesions about the pylorus it is very valuable. These are, as the internist knows, hard to differentiate because the symptoms are so vague and so general and they point towards several different organs rather than to the offending one. I can heartily agree with all that has been said as to the value of the X-ray and of the great necessity of having an expert to interpret the pictures.

So far as the diagnosis of ulcer of the stomach and carcinoma is concerned, I have had the opportunity to see two flecks from a large number of pictures I have had taken in which the trouble was thought to be due to gastric ulcer. One

case, the wife of a colleague from an adjoining state, and the other a patient in the city, showed these flecks beautifully. But that is a negligible quantity. These do not often lead toward a satisfactory diagnosis.

I have at the present time a case under my care in which, with a palpable tumor, I made a diagnosis of cancer of the stomach. My colleague, a very prominent surgeon, and I could not agree. A fluoroscopic examination was made by one of the most expert operators and nothing could be determined definitely, and yet carcinoma was staring us in the face. This patient bled profusely. Gastro-enterostomy showed carcinoma was present. The case shows that occasionally the findings interpreted by an expert X-ray operator may be perfectly negative. How to explain this I do not know and I must leave the explanation for those who know more about X-ray findings than myself.

I am one who adheres to the idea of Leube that there is only one way to determine the motility of the stomach satisfactorily. That other methods may be reasonably satisfactory I agree to; but after all is said and done, the patient is put in an abnormal condition when he takes a bismuth meal. I do not believe bismuth or any other similar meal is a normal substance on which to feed a patient. The general attitude of patients towards it is one of distinct repugnance. The way to determine the motility of the stomach is to give a good Christian meal and not a bismuth meal. Every clinician is aware of the fact that every now and then, when a patient is given a test breakfast or test meal, he knows a stomach pump is to be used in connection with it and as a result of the imaginary terror he experiences temporary stasis. It is the same way with the bismuth meal. I have seen quite a few cases where there was not the slightest suspicion of actual stasis, yet there was a condition of stasis due to nervousness. That is one of the inevitable errors of the method, and in my practice I have come to the point where I rarely give the regulation motor test meal. I have a patient eat an ordinary dinner and see whether the stomach is empty at the normal time. That gives a more correct reading of the motility of the stomach than can be gotten by the radiogram.

We confronted with the same proposition in regard to blood-pressure. We are all familiar with the fact that when a man comes into the office his pulse rate may be 115 and blood-pressure about 160, but as soon as the excitement has worn off his condition is different. This obtains to a lesser degree in the stomach than it does elsewhere, yet for all that it is not to be considered as a negligible factor. While we can learn much regarding the motility of the stomach after a bismuth meal, we are putting the patient in an entirely abnormal condition. We are doing what one author tried to do a number of years ago when he introduced the intragastric bag. When you have a patient who is pretty well trained it goes, but the first time you do it on any patient you find it is unsatisfactory.

I wish to conclude by expressing my great gratitude to röntgenologists for the great aid they give us in certain cases, and still we must not look upon the X-ray as an infallible diagnostic aid in cancer of the stomach. Many internists are at fault in expecting more from the method than can really be legitimately expected from it.

Dr. Arthur Dean Bevan: I think we are all to be congratulated on having the opportunity of listening to the three papers that have been presented this evening. I want to take this opportunity to congratulate the men who gave us this privilege. Personally, I believe that the X-ray has been of a good deal of service in stomach work and that in the future it will be of very much greater service than it has been so far, because I regard it as being distinctly in the developmental stage. I think it gives us a splendid opportunity, if we all combine forces, of doing a good piece of clinical research work. This work needs to be done, not by men like Dr. Elliott, the internist, or by Dr. Case, or by Dr. Potter, or by Dr. Hartung, as a radiologist, or by Dr. Harris, or other surgeons, but this work should be accomplished by team work. It does not do at all for an X-ray man to stay in his laboratory and do the best X-ray work and go no further with it. It does not do at all for the internist to see his patients and make the most careful examination possible and go no further with it. It does not do at all for the surgeon to simply take these cases as they come to him without the aid of these other men and attempt to work out the problem himself. My conception of this problem I shall present to you. We have been doing a great deal of interesting work in the last few years along this line: I suppose my colleagues and I are doing possible a hundred stomach cases a year and these are done almost entirely in conjunction with the internal medical men, and of late, since this work has developed, in connection with the radiologist also I think this would be a mighty good suggestion for team work along this line; i. e., that the internist should take one of these problems and exhaust

all clinical means at his disposal, and then after he has obtained all the evidence that he is accustomed to handle in his way let him draw on a blank form the abdomen with the stomach, the pancreas, liver and gall-bladder in position; and let him outline his conception of the pathological anatomy, or what he believes to be the actual pathologic anatomy in that case, from his clinical findings; then let the radiologist do the same thing. Let him study the case very exhaustively and draw a picture of what he believes to be the pathologic findings in that particular case. We are actually doing this very largely in our own work. If a case comes to operation, or, as a few of them do, to post-mortem examination, the exact pathologic findings can be determined by the surgeon or pathologist. In that way we shall be in a position to unravel many of the problems that are so far pretty knotty ones and difficult ones, and I would suggest that when the surgeon operates on these cases the radiologist be present at the operation so that he can actually see for himself and have a mental conception of the pathologist anatomy in that particular case and check it up with the X-ray findings. Certainly the internist should be at the operation, as he usually is, and see the same findings. There is one thing I should like to suggest to these röntgenologic in connection with the evidence that they must submit to the internist and to the surgeon, and it is this: I am sure their screen work is excellent, of definite value, and indispensable, but the radiologists must bring to the internist and surgeon some evidence, definite, concrete, that the surgeon and internist can study, not in a dark room but in the light; in other words, study the case with the X-ray, with the screen work, as thoroughly and definitely as you can, but you will have to submit to the internist and surgeon a series of plates of what you believe to be the local evidence in that particular case. I feel confident that a good deal of bad work has been done with the X-ray, not only in this particular field but in other fields. At the present time I have many a patient sent to me with a bismuth picture and with a request to stitch up the transverse colon or to take a reef in the stomach, or make an anastomosis between the ileum and sigmoid simply on the X-ray evidence. That is not the sort of work that Dr. Case, Dr. Potter, and Dr. Hartung are doing, but it is the kind of ignorant half-baked work that is done by men with little experience in X-ray work, and these cases are operated on by men with little experience in surgical work. It belongs to such a society at this, and with just such a union of forces as we can bring together, to place this work on a sound useful basis and develop out of it the great possibilities that it is certainly capable of giving.

I want to relate briefly the history and show the autopsy specimen of a case of jejunal ulcer following a gastro-enterostomy with adhesions and perforation into the transverse colon. Dr. Case will show the X-ray findings which were obtained before perforation into the colon had occurred.

Patient, male; age 55; entered the service of Dr. Bevan at the Presbyterian Hospital, 1910, with ulcer symptoms of ten years' standing. He had been treated medically three times with only temporary relief. He was operated on and a duodenal ulcer was found. Posterior gastro-enterostomy was performed. Patient was entirely relieved for a period of nine months when symptoms of the ulcer returned and have continued ever since. He was treated medically for three months in the summer of 1911 and kept himself fairly comfortable most of the time by careful dieting and the use of alkalies between meals.

The X-ray examination by Dr. Case was made in 1911. Two months ago the patient was taken suddenly with pain in the abdomen, some nausea and vomiting, and was confined to his bed for ten days. Since then his ulcer symptoms have been worse. There has been a great deal of belching and flatus. The breath has been foul. There has been frequent nausea and vomiting. No history of undigested food in the stools nor of having vomited fæces. Stomach analysis showed continuous secretion with acidity ranging around 70 and no fæces. Stool analysis showed occult blood occasionally, but no undigested food. No X-ray examination was made.

A diagnosis of recurrent ulcer, location uncertain, was made, and a second operation was performed. On opening the abdomen the transverse colon was found adherent at the seat of the gastro-enterostomy and the anastomosis admitted a finger when invaginated from the stomach into the jejunum. No ulcer could be found anywhere. The duodenum was closed by crushing, ligating with catgut and surrounding the seat of ligation with a strip of fascia from the sheath of the rectus. A half-hour before the operation the patient passed a stomach tube and washed out his stomach, a thing which he was accustomed to doing. After recovering from the anæsthetic he developed pain in the upper part of the abdomen, chest and back. The pulse became rapid and weak and frequent vomiting set in and he died at the end of twenty hours. At autopsy the caused of death was found to be a perforation of the apparently healthy œsophagus 2 cm above the cardia, with hæmorrhage into and infection of the mediastinum. No scars nor ulcers were found in the stomach. There was a scar from a healed ulcer on the superior wall of the duodenum just beyond the pylorus. Transverse colon was adherent to the jejunum, at the seat of the gastro-enterostomy. Upon opening the jejunum a punched-out ulcer the size of a twenty-five-cent piece with moderately indurated walls was found on the anterior wall of the jejunum beginning 1 cm. below the gastro-enterostomy ring. The colon was adherent over the ulcer and extending off from one margin there was a perforation into it, almost as large as the gastro-enterostomy opening. The finger could readily be carried from the stomach into the jejunum and out into the colon.

Ulcer of the jejunum following gastro-enterostomy is now recognized to occur in about 1 per

cent of the cases, and of the more than 150 reported cases that have been confirmed at autopsy or operation about twenty-five have perforated into the transverse colon. This is the third case which I have seen at autopsy and in all three there was a perforation into the colon. In one case eleven years after operation the jejunal ulcer had healed leaving only the jejuno-colic fistula. All of the colic fistulæ have formed in cases where the posterior anastomosis had been made either by the Y or the ordinary method. Several of these cases have been diagnosed and the X-ray findings have been of great service. Bismuth by mouth may be seen in a short time passing over into the left half of the transverse colon, while bismuth per rectum soon passes into the stomach. The immediate cause of death was as unusual as the complicated ulcer findings.

CHICAGO SURGICAL SOCIETY

A Regular Meeting was held February 6, 1914, with the President, Dr. M. L. Harris, in the Chair

Dr. Emil G. Beck read a paper entitled "Present Status of Joint Diseases and Their Best Treatment." (See p. 757.)

Dr. Frederick G. Dyas read a paper entitled, "Streptococcic Infections with Special Reference to Arthritis and Its Treatment." (See p. 734.)

These two papers were discussed together.

DISCUSSION

Dr. A. J. Ochsner: Dr. Beck's enormous experience is certainly very valuable, and ever since his demonstration of the first case we have followed the methods that he has described from time to time. I found it was not very easy to follow the exact directions, however, and in a few cases in which we used a 25 per cent mixture of bismuth and vaseline there was some degree of bismuth poisoning. We also had one fatal case.

I think it is very important in these cases of cold abscesses to use weak solutions.

There is one point that Dr. Beck has spoken of frequently which almost no one seems to remember. Surgeons frequently do not get very good results where there are several sinuses on account of a faulty method of injecting them. Some of these patients have several sinuses as seen in one of the patients exhibited this evening. Dr. Beck tells us to inject the bismuth paste slowly into one sinus until it begins to escape from one of the others. Then he places his finger upon the other sinus and keeps on injecting slowly until it escapes from a third one, then closes that and lets it come out of the fourth, etc. Since we have followed this plan our cases have recovered as smoothly as those of Dr. Beck, but before that they did not.

In the rather acute tubercular infections in knee-joints, especially in children, I have in a good many cases disinfected the skin thoroughly, and made an incision on the external and one on the internal aspect, then applied a large boric acid and alcohol dressing, made extension, put the leg in a plaster cast, and in quite a considerable number of these cases I have had perfect motion afterwards. I would not advise anybody to use this method until I have had about one hundred cases more, but so far I have not had any bad results with them. They have done wonderfully well, and I have had beautiful results. I simply mention this without urging anyone to follow the method, but until we have a bad result in one of these cases I shall continue to use it.

The paper of Dr. Dyas is very interesting and instructive.

Dr. Beck (closing): I am glad the subject of bismuth poisoning was brought up by Dr. Ochsner. Although I have it in my paper I did not speak of it. In over twelve hundred cases treated with bismuth paste in the practice of my brothers and myself, we have not had a fatal case because we have been exceedingly careful. I have a case now in which the patient barely escaped having bismuth poisoning; it is a case of empyema. As soon as I discovered the signs of intoxication I washed out the paste with olive oil, and all symptoms disappeared.

While in St. Louis about two months ago I was informed by a prominent surgeon there that he had a case of bismuth poisoning. I went with him to the hospital and saw a case of severe intoxication. This was a case in which there had been a psoas abscess, into which the doctor had injected about eight ounces of the paste and

"left the bismuth in." He showed me a picture, and I asked him what percentage of bismuth he had used, and he replied, "Just what you prescribed." From the density of the shadow I could judge that instead of a 10 per cent mixture, a much stronger mixture had been used, and furthermore, the paste had been left in the cavity. This was a mistake. We immediately opened the abscess and washed the paste out with oil. Subsequently I received a note from this surgeon in which he expressed his gratification at the disappearance of all symptoms of bismuth poisoning. I believe that patient would have died if we had not promptly done the right thing, as only mouth washes were being given by the internes.

I have here a young man who for twenty years has had hip-disease with eight sinuses. He has a rectal fistula resulting from the hip-joint disease. I here show a stereoscopic radiograph of his case, which is rare and most instructive. He has no ischium on one side; it was all destroyed by the disease. You note that the paste passes from the hip-joint through the abdomen to the rectum. The other openings are all around the hip-joint. He has improved considerably since receiving the injections.

There is one point I wish to allude to which may interest you. I want to explain why all these patients gain so much in weight. Here is a patient who weighs ten pounds more than he has ever weighed in his life. Many of these cases gain in weight out of proportion to their previous normal weight. How can we explain a gain of two or three pounds a day for one or two weeks. I have had some of these patients gain fifty and sixty pounds. I have a theory that I have advanced, and it is this (illustrating on the blackboard by diagrams): When a chronic disease like tuberculosis develops it simultaneously produces a corresponding degree of immunity. The longer the disease lasts and the more organs are affected, the greater will be the degree of immunity. In other words, the immunity tries to keep pace with the progress of the disease. If a man has tuberculosis of the testis, kidney, and bladder, each disease-producing area will produce its proportion of immunizing substances. Let us present this in figures. Let us suppose a man has ten units of the disease in the kidney, five in the bladder, and ten in the lung, a total of twenty-five. He has already developed an immunity of eight from the kidney, three from the bladder, and seven from the lung. He is shy two, two and three, correspondingly. He needs an immunity of twenty-five. As soon as the units of immunity overreach the units of representing the disease-producing areas or toxines from them, spontaneous cure takes place, such as you find in thousands of cases of tuberculosis of the lung. This margin of needed immunity can be produced artificially by fresh air, vaccines, sunlight, and by different treatments. But what we are doing is something different. We reduce the disease-producing area. If we remove the man's kidney, he has left a disease producing area of only about fifteen, and the existing immunity of eighteen is sufficient to take care of all the remaining disease in other parts of the body. If you remove a tuberculous kidney from a patient having a coexisting tuberculous bladder, the tuberculosis of the bladder gets well without any treatment, although previous to this time you may have tried everything without effect. These hip-joint cases are similar in nature. I have treated cases of hip-joint tuberculosis in patients who have had pulmonary tuberculosis as well, and yet by treating the hip-joint disease the pulmonary condition has cleared up without any other treatment. I have statistics of my cases and of experiments on animals bearing on this, and some day I will publish them to prove my contention.

One patient for whom I removed a tuberculous testicle, recovered from a pulmonary tuberculosis which existed at the time. As stated, I have made extensive experiments on animals, but have not had the time to work them out completely.

DR. A. J. OCHSNER: While I was in Professor Albert's clinic in Vienna twenty-seven years ago, he showed us case after case in which there was pulmonary tuberculosis and tuberculosis mostly of the ankle-joints. He would say that "if we amputate in this case, the patient will get well, but if we do not amputate and resect the tuberculous joint, the patient is likely to die." He did not give any explanation for saying this: it was simply his experience in many cases.

DR. FREDERIC A. BESLEY: I wish to express my appreciation of the paper of Dr. Dyas, which was most instructive to all of us, and he deserves great credit for the type of work he has been doing. I believe this is another bit of evidence as to the fallacy of all antiseptics used in this way. I believe it teaches again that antiseptics used in joints or used on any surface are not capable of producing any germicidal effects on the organisms that are really doing the destructive work. These organisms are not on the surface, but in the surrounding tissues, in the lymphatics; and it

is impossible to use a germicide strong enough or powerful enough to in anyway inhibit the action or destroy the organisms without destroying the tissue.

His deductions as to iodoform and formalin reducing the resistance of the tissue of the joints to infection are most logical and timely.

Dr. Charles Davison read a paper entitled "Treatment of Fractures by Medullary Bone Splints." (See p. 750.)

CHICAGO GYNECOLOGICAL SOCIETY

A Regular Meeting was held January 16, 1914, with the President, Dr. Frank W. Lynch, in the Chair

Dr. Eugene Cary (by invitation) read a paper entitled "Death of a Full Term Fœtus due to Constriction of the Umbilical Cord by Amniotic Bands; Rupture of the Amnion; Hydramnios." (See p. 730.)

DISCUSSION

Dr. Charles E. Paddock: The report of the case by Dr. Cary brings up the subject of antenatal pathology, a subject of so much interest and yet so little known. Ballantyne of Edinburgh has probably given us more enlightenment upon this important study than any one. Several journals have been established, devoted entirely to subjects of antenatal pathology, but for lack of patronage these journals survived but a short time. The numerous articles, however, presented showed a widespread interest in the subject. I cannot say that cases such as the speaker has presented are rare. Personally, I have not had or seen one just like it. Of course, I have seen amputations and skin-lesions said to be the result of amniotic bands or adhesions in the early pregnancy. And, as I understand it, amniotic bands and adhesions, due to the amnion, belong to the neofœtal period and not the fœtal period; that is, they belong to teratology, rather than fœtal pathology. This case, then, is unique in that according to the speaker the amnion ruptured late, due to a hydramnios, and that later these amniotic bands so constricted the umbilical cord as to shut off the circulation and destroy the child.

Dr. Rudolph W. Holmes: The statement has been made that a band ruptured the membrane and the amniotic fluid gradually worked its way between the membrane and the amnion and chorion and separated it *in toto*. I do not think that had any bearing on the case at all. Usually rupture of the amnion — or more commonly as we see it, rupture of the chorion — may take place because occasionally there is no coalescence whatever of the amnion and chorion; and the chorion for some reason or other may rupture with the amniotic sac, and rupture of the chorion occasionally is accompanied with the escape of a considerable amount of fluid. I think there was failure of coalescence of the amnion and chorion in this case, and the baby's leg or arm might have been caught by that band, and the amnion was weak enough to permit it to be torn, when it gradually floated until it gathered up around the placenta.

Dr. Frank W. Lynch: A paper like this is very timely in calling our attention to certain points which do not seem to be very well understood by men who have not devoted much time to this branch of medicine. Within the last few days there was a paper read at one of the special societies in town based upon some experimental work concerning fœtal movements in asphyxia. I think that sometimes we lay ourselves open to criticism of such work as has been done by Ahlfeld and his followers from Marburg way back in the eighties, because cases of this type have not been reported. I recall what a shock it was to me when I first appreciated that my lot was to be able to tell pathologic fœtuses and ova, at a time when some of us were very lucky to be able to tell that they were ova, and that they were pathologic due to deformity of amnion. I would like to ask Dr. Cary whether sections were made from the constricting band.

Dr. Cary: No.

Dr. Lynch (resuming): This case must be unique if the literature fails to give a like example. Mention should be made of the work which Ballantyne did in his antenatal pathology and the spasmodic attempts that came out of Bohemia of work on this line in the causation of pathologic formations.

Dr. Paddock: In 1856, G. Braun reported a case of this kind. Whether it reached term or not I do not know, but the case was published in a

French Medical Journal and in the German Journals.

DR. CARY: I have quoted that case in my paper, and it is the nearest in nature to the one I had.

DR. FRANK CARY: I want to make one or two remarks in connection with this case. If these amniotic bands were of long duration, lying free in the cavity, the amnion removed from the chorion, I do not believe if they had been strong firm bands they would have broken. They were recent bands or they would not have been in that condition. I may be wrong in my supposition, but that is the way it strikes me. If the literature is correct, if this amnion had been long ruptured, the fringe of amnion left would not have been in that condition. It would have been in the condition of being curled up and more or less disintegrated. This amnion was not so disintegrated, and that is why I believe it was of recent date.

DR. EUGENE CARY: Dr. Paddock spoke first of these bands being arranged more like adhesions, and that is the point I want to bring out. You can get more literature on amniotic adhesions than you can cart off in an express wagon, so I purposely side-tracked that part of the discussion altogether. Then he asked, Why did not the amnion rupture early, and was this merely a late result? The question can be answered in several ways. First of all, these bands when the child was born were entirely free and tied around the cord, but, as Dr. Frank Cary stated, these bands were formed of firm tissue and the amnion that was left around the cord was perfectly free and was not thickened or changed in any way, except having been torn. That, with the literature behind it, means a great deal because in all the cases reported, some twelve in number, the amnion was all rolled up excepting in the case reported by G. Braun in 1856. Lovedale goes further and states that in these cases where the amnion has ruptured early the chorion becomes very much inflamed and changed, so that it cannot in some cases be stripped off the lining of the uterus. The inflammation becomes so great you cannot get it all off with a curette, and the placental membranes are delivered intact without being torn, without anything left behind, and the placenta was delivered spontaneously. Dr. Lynch speaks of asphyxia in these cases. If this woman had been in the hospital and watched at the time this severe constriction of the cord occurred, the baby with severe infection might have been saved. Jones, in one of the British journals, has written an article on the same subject in which he mentions constriction of the cord in a twin pregnancy where there was excessive movement of the twins and then all life ceased, and on delivery he found the cords of the twins had been twisted in such a way that death resulted. I wish to thank Dr. Franklin for translating the Russian article for me. I spent three months off and on going over all the literature. I went back as far as '61, followed the different clews and asked different men who were interested in this particular branch regarding these cases, and I have not found any cases similar to this one, except the one by G. Braun in which the amnion ruptured late and where there was constriction of the cord by amniotic bands.

DR. CHARLES S. BACON: In connection with the remarks of Dr. Lynch and the closing remarks of Dr. Cary, I wish to suggest the possibility of diagnosing danger to the child *in utero* and the possibility of timely interference. The part of the report that dealt with that interested me very much. Within the last ten days I have had the case of a woman who had lost two children previously, one having died *in utero* a few days before term.

On account of the history I had the woman go to the hospital about ten or twelve days before labor was expected and had her watched carefully. I had the fœtal heart tones counted at regular intervals every two or three hours day and night. We found a variation in the heart tones of between 135 and 164. At the time when the child's movements were excessive, the woman was having considerable distress; the heart tones were unusually rapid. The regular heart tones we had previously determined to be 140. On account of the history and the fact that she had a cross presentation with breech below, I made a cæsarean section nearly one week before the expected delivery of the child. I found a rather unusual condition. We had a very large placenta which was bipartite. The cord came off between the two sections of the placenta, but whether this had anything to do with the condition I do not know. However, the practical bearing on the subject is interesting.

If it is possible in these cases of antepartum death of the child to diagnose this condition by the heart tones we may save some of these children. Just how much variation there is in the heart tones I do not know. I have not had time to look the matter up and see whether extensive observations have been made on the subject. Since this subject came to my attention a few weeks ago I have taken occasion to count the heart tones in a number of cases, and have found there is not much variation in those cases I have examined.

DR. HOLMES: What caused the variation in the heart tones? Was the child endangered when you got through with the cæsarean section?

DR. BACON: The child was not asphyxiated. It is apparently a healthy child. The placenta was extremely large: it nearly filled the whole

uterus. This led to considerable difficulty in getting the uterus to contract.

DR. HOLMES: It has been a common observation of mine that there is considerable variation in the heart tones. For instance, a woman will come into the office and when you first count the heart rate it will be one hundred twenty; you may palpate the baby and press the head and see how firm it is fixed in the brim, and if you count the heart again it will be 150, 160, or 170.

DR. EUGENE CARY (closing): Referring to the case related by Dr. Bacon I have had a case somewhat similar to it. The placenta, instead of being one piece, was in two halves.

I had a case about a year ago where I was called out at three o'clock in the morning to see a woman who was reported to have had a severe uterine hæmorrhage about an hour after the onset of labor. This day she had passed over a quart of blood up to the time they telephoned, so I hurried out there and saw the woman, who previously had had a fairly large abdomen and apparently a condition of hydramnios. She was apparently in labor and in good shape, and I did not examine for the fœtal heart tones, because the bag of waters had ruptured and the fœtal heart tones were in good condition, and I did not believe she had this enormous hæmorrhage. I was finally convinced by seeing that it was not all blood but water mixed with it. It was tinged with amniotic fluid. So I was quite at a loss to know where all the blood came from without continuing. There was no placenta prævia or suggestion of one. The baby was delivered, was perfectly healthy, and all right, and then we delivered the placenta and made an examination to see where the hæmorrhage had come from, and in carefully examining the placenta it was similar to the one Dr. Bacon described. In this case there was a large mass of placental tissue on the right side, and on the left side there was a mass about one-half that size. The blood-vessels ran out into the membranes and from there up to the cord. When the labor pains started the contractions began to stretch the membranes, the cervix was effaced, the os dilated, and the stretching was put upon the blood-vessels, and luckily for the child the membranes ruptured. One of the vessels between the cord was torn clear across, both ends were contracted, and that vessel was bleeding and giving all this hæmorrhage. As long as the amniotic sac held intact the blood was forced in the amniotic fluid, but as soon as the sac ruptured the water rushed out, the uterus contracted down, the fœtal head pressed against the broken vessel, every particle of hæmorrhage ceased, labor went on normally, and the child was delivered.

Dr. William Cuthbertson by invitation read a paper entitled "An Improved Gilliam Operation for Uterine Displacements" (See p. 721).

DISCUSSION

DR. ALBERT GOLDSPOHN: I had thought that this subject was quite exhausted without having an additional modification of the transplantation of the round ligaments in the abdominal wall; yet other men have a right to their opinions, and if we are to have one more modified operation, all right, as long as the fundamental principle that governs all these operations is correct; viz., that you deal with the thick end of the round ligament to do service, and not make the mistake that is made in the Baldy-Webster operation, and that of Dr. Ries, whose technique is anatomically wrong because it places dependence upon the terminal, useless, outer end of the round ligament to do good or to hold; and this it can not do.

Practically all men except a few general surgeons like Dr. Coffey are agreed that the round ligament is the thing that we can rationally use and depend upon, and the argument of some of the pettifoggers to the effect that the round ligament does not serve to hold the uterus forward is a weak one. We do know that it does something in that direction, but how much we do not know; and I do not care. If the round ligament up to the time of the operation has had no function, there is nothing at all in opposition to my giving it a function. It will give good service. That, all the gentlemen know who deal with the round ligament in the right way. There are a dozen different ways of making an efficient transplantation of the median useful end of the round ligament into the abdominal wall. The Montgomery, Noble, Barrett, and many other modifications of the Gilliam operation are all correct, in my judgment, in that they make use of the thick end, the uterine part only of the round ligament to do service. They make it serve by changing its course and securing a new attachment for it and ignore the outer end. In the main these operations are all of a substantial character; but there are differences. They are not all equally applicable to various kinds of cases. For instance, if you want to do the operation of my friend here, Dr. Barrett, on a patient who has had a severe pelvic peritonitis, if the broad ligaments and round ligaments are thoroughly infiltrated, and you want to separate or isolate the round ligament to such an extent as is necessary to draw the loop as far laterally as the location of the internal abdominal ring, and from there out in the abdominal wall, you will not be able to do it; and this he has admitted himself. But it is a different thing if you simply pick up enough of a loop to pass directly straight forward through a blunt puncture, not as far as Dr. Cuthbertson goes, but say about an inch laterally, from the median incision, through the rectus muscle and aponeurosis and anchor it in these firmer structures. This can nearly always be done. Dr. Cuthbertson proposes to make the attachment to the aponeurosis of the external oblique, which is much weaker and in some women will be a rather delicate thing. Some objections have been made to the

idea of stab in the abdominal wall to pass such a structure through. It requires nothing of the kind. There is no stabbing done. We can take a slender artery forceps and pass it through about the middle of the sheath of the rectus, through the aponeurosis, muscle and structures within, and draw the round ligament through, with the same slender forceps after having previously isolated a loop within, and without any intervening loop or strip of gauze or ligature whatever, simply from one forceps to another upward and outward. As the years have gone by and the hundreds of cases have multiplied that have been subjected to this procedure, I have grown to have this feeling, that it is the argument of a pettifogger to say that the uterus is strictly a pelvic organ, that it should not be drawn out of the small pelvis, that it does not belong in the abdomen, and that it has no business being near to the abdominal wall. I can refute such an argument by reporting hundreds of cases. I have this feeling now as the result of what I consider mature experience, namely, with about 100 cases yearly for at least ten years in which I have performed this modified Gilliam operation almost alone. I find that the higher the ovaries are drawn out of the small pelvis the better is the return current of venous blood, and the more subjectively comfortable is the patient. The idea of being afraid to draw the fundus uteri out of the pelvis, and approximating it to the lower part of the abdominal wall an inch and one-half or two inches from the border of the symphysis pubis, is erroneous. It is a mistake to go much higher than that. I would not make these punctures through the recti over two inches away from the symphysis, often less; and the method of drawing up the loop of round ligament occludes the part of the peritoneal cavity below that point crosswise from entrance of intestine into it thereafter. The lateral portion of the round ligament is drawn up so snugly that it effectively occludes the space laterally from the point of anchorage on each side, and the fundus uteri closes the median space. It is my belief that the intestine does not enter the lower inch and one-half of peritoneal space. Such a thing as interference with the intestine or intestinal obstruction, I have seen once only. This was about fifteen years ago when I first tried this operation. I was afraid to draw the uterus up high enough, and a knuckle of intestine probably worked down between the fundus and abdominal wall; and later the patient had symptoms of intestinal obstruction. These disappeared, however, without surgical intervention. This is the only case of the kind I ever saw. We should properly open the abdomen to cure retroversion; because we have so many other important things to do for these cases. It is our duty to remove the appendix in practically every one of them. Such cases admit of the removal of the appendix every time. Howard Kelly was very correct when he said fifteen or twenty years ago that after the abdomen has once been opened and surgery has been done in the vicinity of the appendix, it is thereafter in greater danger of making trouble on account of adhesions to which it is apt to become subjected. Therefore, when we open the abdomen and attend to this minor retroversion work, we should make an incision—or more than one—that will give us access for every other surgical act that may be called for in that abdomen. I think this intensified Gilliam operation, which secures the uterus and its adnexæ on a higher plane and in pronounced anteversion, is the best. Aside from my favorite bi-inguinal operation of past years, I have not discovered any procedure that will secure as much comfort as well as stable and innocent results for the patient. It can be done quickly leaving the greatest possible time for work in the upper abdomen. You can put your hand up there and if there is anything that is suspicious you can make a second incision, and do what is necessary to be done.

DR. THEODORE J. DOEDERLIN: I was prompted by the writings of Dr. Howard Kelly in the early part of my practice to apply ventrosuspension and ventrofixation. He was my authority then, and so far as I was able to follow up the cases I never had any untoward results, but I invariably resorted to the anterior operation. I did not turn the uterus out, but sewed it to the posterior part. I had one woman who was confined twice after that, and she never had any trouble. Later I abandoned that method and for the last five or six years I have been doing the Gilliam operation. I have had six or seven cases, mostly private cases, which I have had occasion to follow up and the results were all good except in one. That was the first case I operated on, which was one of extensive puerperal or post-partum inflammation, the patient having come to me from out of town, and in that case there was a recurrence. The uterus fell back. Since then I have not had any recurrences, but have had a partial slipping in one case and that I attributed to the catgut I used. I sewed around through the aponeurosis to the outside with three sutures, and I thought it was safe. I never gave it any thought. Since the partial slipping back I have used the Pfannenstiel incision, and run that through, first

entering the aponeurosis, going through the round ligament and tying it over a piece of gauze, feeling I was safe, and with the silkworm-gut suture tied the round ligament, taking the suture out after ninety days.

I would like to congratulate Dr. Cuthbertson on his ingenious operation. Speaking of the Baldy-Webster operation, I do not think I need to emphasize at all that there are two reasons to my mind which speak against it. In the first place, it shortens the thick or strong part of the ligament; in the second place, there is constriction of the uterus. A friend of mine had a case where the uterus tipped up and there was a retroflexion carrying the round ligaments backwards. There is very little or no danger to the perineum, as I sew the aponeurosis together with my extra stitch. To avoid strangulation I now use iodine applied to the part which runs from the internal ring to the stab, so that there will be adhesion formed. I never had a chance to investigate whether it was properly adherent or not, or whether there would not be a hernia at that place. I have never seen Dr. Goldspohn operate very much; he is an expert in the method he has described, but in my humble opinion in drawing up the uterus as he does there is too much tension on the ligaments, which is hardly advisable, so that the uterus is crowded naturally to the front, and we may get ventrosuspension. The top of the womb will be adherent to the incision. With the Pfannenstiel incision you can make a cross section of the aponeurosis. He does not do that, but makes a nipple there which is nice for his special way of operating.

Dr. Channing W. Barrett: The probabilities are that every person here, except Mr. Whitford, who has reported so many discussions on this subject, is perfectly satisfied as to what operation he will do for retrodisplacements of the uterus; otherwise, if he were to operate to-morrow he would be considerably confused from all he has heard upon this subject to-night. A paper of this kind is chiefly valuable because it gives an opportunity to deal with principles and compare methods. The principles of support are that we want the uterus held forward, not that the much doubted intra-abdominal pressure will fall upon the posterior surface of the uterus, but nature has decreed that animals in the upright position should not have the uterus in line with the vagina, and the vagina longitudinal with the body. Every once in a while we hear a person sneer at the idea of the round ligaments holding the uterus forward, and yet they forget that nature said that, and nature has said it over and over again until it grew a round ligament for the upright animal, the round ligament being a structure developed in upright animals, and that it is for the purpose of dragging the fundus forward. We do not have to indulge in any more talk about the value of the round ligament to hold the uterus forward. The question largely is this: How shall the round ligament be used when it has once become stretched and the uterus got back in line with the vagina? Shall we use the stronger or weaker part of the ligament, inasmuch as one is stronger than the other? Some have said the poor part of the ligament is plenty good enough. When they say a thing is good enough it is abundant evidence it is *not* good enough. There is nothing that nature has made that is good enough at all times, and there is nothing in surgery that we can do that is good enough if it can be done better, and so we should use the strong part of the ligament if we can, and not the weak part. I believe in the main with what Dr. Goldspohn has said. I believe more fully in what he said when he talked about the principles of this work of dealing with the round ligament through the internal ring. He taught principles that are fundamental and important, but he has departed from those principles somewhat in his later years. He has gone wrong somehow. That is one of the chief arguments against the old operation of ventrosuspension in favor of bi-inguinal celiotomy, of having the ligament run through the abdomen transperitoneally, and yet the operation he proposes or follows, following the Gilliam, is to run the two ligaments through the peritoneal space around which omentum or intestine can become entangled. We not only want to use the round ligament to hold the uterus forward, and the very best part of the ligament, but we want it placed so it will be in a normal position. They should not run through the peritoneal space and furnish opportunities, as the Gilliam does, to entangle bowel. And so, following the principles which Goldspohn and others have laid down, I devised a procedure of coming out through the abdominal wall to the ring, bringing the ligaments out at the place they normally come out of the abdomen, so that there is no opportunity for bowel to become entangled around them. It is a fundamental principle that no structure should run transperitoneally.

As regards this modification by Dr. Cuthbertson, when Gilliam first proposed his operation a good many of us thought it was the best operation offered the profession up to that time, and I performed it for a few years, and I never knew a single one of these cases have the ligament slip out. I

have never known one of these patients to return after the operation was performed on account of a recurrence of the displacement, but I have seen conditions that were pathologic from that procedure. The doctor spoke of the operation which I have devised as furnishing an opportunity for the ligaments to become loosened and to slip. I have performed that operation for ten years, and I have never known a single case in which I thought the ligament gave way, and went back into the abdomen. Dr. Goldspohn usually in discussing this lays some stress upon the trauma the operation produces. From the standpoint of trauma we have in mind two things. While once in a while we will have a hæmatoma by coming out at the external ring and bringing the ligament through the internal ring, and once in a while we will have a hernia, I must say that in ten years not a single hernia or hæmatoma has occurred. When I read a paper nine years ago on this subject and Dr. Goldspohn discussed it, he said it was theory. It is a fact, now, that we do not have these things occur; so that whether one choses for the operation opposing ligaments, which is the method which furnishes greater trauma and produces more injury to tissue and necessitates greater work, or whether we simply do the method of fastening as Gilliam has proposed, I do not see that there is any great point here, because the ligament has not given way. In regard to the incision, if we examine the charts of Dr. Cuthbertson and we are to judge from the size of the ligaments shown, the size of the longitudinal incision, the size of the forceps, etc., this is minimized from the normal size, and yet if that incision is equally minimized, I should hardly suggest that as a method of operating for retrodisplacements of the uterus.

Dr. N. S. Heaney: Dr. Goldspohn spoke about one case in which he had strangulation in the lateral loop of round ligament but which did not require operation. I would like to know how he made the diagnosis of strangulation of the gut through the lateral loop.

Dr. Channing W. Barrett: Reference was made to the point that in cases of infiltration the ligament cannot be taken out through the ring. I have always taught that the procedure of shortening the round ligament in that way could not be done in cases of infiltration, and I observed that precaution in doing the Gilliam operation, and I should likewise observe it if I were going to do the Gilliam operation at the present time. The Gilliam operation, or the shortening of the round ligament through the ring, is not at all fitted for those cases that have infiltration and a mild sepsis such as he speaks of. Neither one of these procedures should be done in such a case.

Dr. Albert Goldspohn: Dr. Barrett did not listen to what I said. There is practically no space left in front of the uterus between it and the bladder. I have had occasion to open up some of these women again for other pathologic conditions, and I am prepared to say that the intestine does not enter below my approximation to the abdominal wall. If that is true there is no such thing as "snarling by the two ligaments," because the intestines do not pass below or around them. Nor will the fundus uteri become adherent to the abdominal wall merely from contact with it, if we do clean surgery. In the matter of infiltration of the round ligaments, I should be very sorry if I had to back down, and forego the use of the round ligaments entirely because of such infiltration; for only some barbarous fixation then would remain available. Not so with my use of the round ligaments, for they still serve best even in the borderline cases in which the most extreme use of conservative surgery on the adnexæ is made use of to save or to restore a small prospect for conception. In these cases, a ligament will occasionally tear off. An Olshausen fixation of the cornu is then made. The round ligaments must not be dissected out from their peritoneal envelope; but this—i.e., the upper part of the broad ligament—must be freely made use of with the round ligament in order to close off the lower part of the abdominal space as above described, and to secure stable results.

Dr. Heaney: You have not answered my question.

Dr. Goldspohn: In the first place it was something like ten days after the operation when the patient had intestinal obstruction. There was no doubt about that, and there might be a question whether the passage of the bowel had occurred in the median line between the fundus and abdominal wall, or whether it had occurred in one of the lateral portions over a round ligament. But in those days I was afraid to draw the uterus up as much as I do now, and there was more space between the fundus in the median line than there was laterally. Any one could see that by the way we draw the loops up. That is my reason for it. So far as hernia and recurrence of displacement are concerned, I will take the challenge from anybody. I do not wait on obstetric cases very much, but my assistants attend to this work largely in this city. From them and from practitioners outside, as well as from patients themselves, I am pretty well informed about the remote results in these cases. If anything serious

happens in connection with the operation I have done, I am quite sure to learn of it. There are no herniæ. A return of the displacement after this operation—there may be one case in two hundred, although I know of only two cases; and the percentage of recovery to health and comfort is equaled only by that glorious operation that I used to do — bi-inguinal celiotomy.

There were twelve years during which I made the *extended Alexander operation* fit nearly all the retroversions complicated with adhesions and diseased adnexæ (short of pus tubes). I liberated adhesions and resected or removed individual tubes and ovaries and shortened the round ligaments most ideally, through the simply dilated internal inguinal rings and canals.

In the hands of some twenty operators in America and Germany, about eight years ago, this procedure and other types of thoroughly modern Alexander operations counted nearly three hundred cases who had borne one or more children after their operation, with only about ten cases of recurrence of displacement. So crucial a fire of scrutiny and criticism all other retroversion operations together have never passed through. If retroversion were all that requires surgical treatment in the abdomen of women who have this disorder, then I would be doing this same bi-inguinal operation this day.

Dr. William M. Thompson: The last word on retrodeviations of the uterus has not yet been said. The real crux of Dr. Cuthbertson's paper, it seems to me, has been overlooked by the previous speakers, and that is the utilization of this tendon, or aponeurosis of the muscle; and the strong point in that is that it does not constrict the ligament. I think most of those men who draw up the ligament, tie it securely, and sometimes too securely, and in that way cut through the ligament, destroy its function, and the point made by Dr. Cuthbertson is that he deals with the utilization of this tendon or aponeurosis of the muscle for a suture.

Dr. N. S. Heaney: I have been following the Webster operation, which utilizes the uterine end of the round ligament. We have been very well satisfied with our results.

Dr. Polak recently published a paper in which his results following the Webster operation were not encouraging from our viewpoint, chiefly, we believe, because he performs it in a different way. Although those men who do the Gilliam operation have never seen strangulation of the gut, I who never have done this operation have seen strangulation of the intestine in two cases, one confirmed by autopsy and the other by operation, and I have heard of strangulation of the gut occurring in the practice of others. While I believe that the extreme outer end of the ligament theoretically is the better part to shorten up I don't believe that it is a matter of much practical importance and we expect to continue to use this method in the majority of our retroversion operations.

Dr. Mark T. Goldstine: As has been said by Dr. Heaney, you cannot pass upon an operation you have never done. The Webster-Baldy operation has been found satisfactory in the gynecological service at Wesley Hospital, and most of the general surgeons are using it, and Dr. Webster, Dr. Baldy, and Dr. Andrews are not responsible for every man's technique who tries to do that operation; so that if the uterus tips backward, they should not be criticised. A word about the Watkins-Wertheim operation: It is not primarily an operation for shortening the round ligaments by the vagina. Dr. Watkins shortens the round ligaments that way, but his operation is devised for extensive prolapse and cystocele, and not for shortening of the round ligaments. Furthermore, we are not of the opinion that shortening the round ligaments in correcting retroflexion will cure cystocele. We look upon cystocele as a hernia of the bladder, and by dealing with the ligaments and doing anterior colporrhaphy, you will get results. The Webster operation has been constantly successful with us, and is consistent with pregnancy. I have worked that part out and studied it carefully for Dr. Watkins, and we are satisfied with the results we get in pregnancy following the operation. Sometimes after shortening the round ligaments we advance the peritoneum of the bladder up to the top of the fundus of the uterus, and suture the broad ligament to the uterus where it comes through so that it is only a slight modification.

Dr. Chauncey W. Courtright: I feel that the Barrett operation, as he describes it, suits me better than any of the other methods with which I am familiar. I have seen many of these operations performed by different men, each with a little variation in technique, and yet, after all, it does not depend so much upon the strength of the round ligament as a great many would have us believe. However, I believe a mechanical principle obtains here as anywhere else; namely, if the uterus can be brought forward and held there, there is no reason why it should go back. If there are adhesions present they must be looked after. If the uterus is put in such a position that viscera will fall down behind it, there is no reason why it should require a hawser to hold the uterus

forward. I have heard it said to-night and emphasized that we should utilize the stronger portion of the round ligament. The question arises, Which is the stronger portion? Who has demonstrated it? Who has demonstrated which is the stronger portion of the muscle, the tendon, or the belly of the muscle? The fleshy part of the round ligament to my mind is more likely to give way than the tense fibrous part which is smaller, but fully as strong. In other surgical departments we look for a break in the muscle, not in its tendon, but in the belly of the muscle. I have had the biceps fracture in the middle, but never found a tendon fractured from traction or tension or pulling. I am not convinced that the stronger portion of the ligament is the more durable or permanent part of the round ligament, and that it is the only part to use in bringing the uterus forward and holding it there.

DR. LOUIS FISHMAN: We hear a good deal about the Gilliam operation and of strangulation of the intestine following it. Dr. Heaney said he knows of two cases of strangulation of the intestine following this operation, and there are other cases reported in the literature, although Gilliam himself denies this. He says that in all cases in which strangulation has taken place the round ligaments have run through abnormal or transperitoneal space. In order to overcome this defect, Dr. Barrett has devised his operation of bringing the round ligaments out through the abdominal ring, and his operation fulfills all the requirements of the Gilliam operation itself, and does away with the undesirable defect of dividing the peritoneal cavity. It produces a normal condition there in that the round ligaments should normally run outward, forward, and upward, while with the Gilliam operation they run forward, so that in the Barrett operation the uterus is supported by the round ligaments in a forward and outward direction.

Dr. Goldspohn has said that if we pull the uterus far enough forward we will overcome this defect. Personally, I have had no experience with the Gilliam operation, but I have had experience with the operation that Dr. Barrett has described in working with him and in my own work, and the results have been satisfactory. I have seen two cases in which the Gilliam operation was done, and the uterus was brought so far forward that both patients complained of extreme irritability of the bladder. Dr. Goldspohn spoke of the Webster operation fulfilling the requirements, and of patients going through pregnancy without any trouble, and the uterus remaining in position after labor. I have seen several of Dr. Barrett's patients who have gone through pregnancy and labor, as we have had the privilege of examining them subsequently, and we have found the uterus in its proper position. I have seen one case that has gone through two pregnancies, and the uterus has remained in good position. Personally, I have two cases that have gone through pregnancy, and the uterus is still in good position.

Dr. Heaney spoke of the weak and strong part of the round ligament. There is no question at all that the uterine end contains considerable muscle, and as we go out towards the internal ring the musculature disappears and becomes fibrous. Early in my medical career I learned that a scar is the weakest part in the body, and I still believe it, and the outer end of the round ligament is fibrous tissue, the same as a scar, and I should say would stretch much quicker than the belly of the muscle; so that while the Webster-Baldy operation or the Andrews-Webster-Baldy operation may give good results, it is the operation that utilizes the poor part of the ligament which is the better.

DR. FRANK W. LYNCH: There is a great similarity about these operations. In fact, no matter which one of the numerous operations you perform, there are successes and there are failures. It really seems that failures depend upon not how much we drag the uterus forward, but as to how we keep the cervix back at the same time we keep the uterus forward. I have known Kelly operations to be successful, and they are nothing but films of tissue and scar tissue. They do not do very much toward holding the uterus forward. It depends very largely upon the uterus which must be at the base of the broad ligament, and if we have a good pelvic floor, it does not make much difference what operation we do. I am a dissenter because I do not believe these displacements alone require much, if any, treatment. I do not believe we should operate upon these cases unless the uterus is enlarged or the patients have prolapsed ovaries or some thickening. Some of these patients do not complain of symptoms. I like to read papers by men who emphasize the point that the recurrences are frequent from practically any operation if we do not spare our sutures. We should all emphasize the fact that a pessary should be used, where there has been plastic work done, to keep tension off of the sutures.

DR. CHARLES E. PADDOCK: I am glad Dr. Lynch made the last remark. I have seen many cases following labor, when operation had been suggested for backward displacement of the

uterus, yet by supporting the uterus with a proper fitting pessary for a few weeks or months the operation was no longer indicated. It would be interesting to know from these gentlemen who find so many displacements calling for operation just what percentage had had similar treatment.

DR. LYNCH: I meant the use of pessaries after operations.

DR. CHANNING W. BARRETT: I thought this ground had been covered until the last speakers had talked. They have not struck the right operation. When a person gets up and says that all of these operations are alike, and that there are a number of cases in which recurrence of the retrodeviation has taken place, it is perfectly evident the right operation is not being done, because patients who undergo these operations are entitled to something better than that vague sort of thing. As regards the use of pessaries, I would say that an operation that is done properly for holding the uterus is not going to require the use of pessaries to hold that organ in position. Dr. Paddock is dealing with obstetric cases, and there are obstetric cases that have retrodisplacements which require a pessary or support to hold the uterus in proper position during the early weeks or months after confinement; and if the patient has a good pelvic floor, the practitioner will have success in keeping the uterus forward. On the other hand, in the gynecological cases where the retrodisplacement has gone on for months, the practitioner will not meet with success with any line of pessary treatment that can be carried out, because we have tried it and have failed.

DR. N. S. HEANEY: If Dr. Barrett has never seen a recurrence after his operation it is because he has not done a sufficient number of them, for if retroversion occurs occasionally in those who have previously been normal, what is to prevent its occasional recurrence after operation? Because a woman has a recurrence after labor is also not proof that the operation was not properly performed or was not the proper type of operation since we all know that a pregnancy causes most retroversions and displacements. It is not the fault of the operation, but it is a thing liable to happen after confinement, no matter whether the woman has had an operation or not.

DR. ALBERT GOLDSPOHN: I have made observations on what can be done with a pessary in the puerperal uterus, on a small number of cases. My conclusion so far is that if we take the average labor case (not the one where there has been severe infection), examine her two weeks postpartum, and on finding a retroversion, order her to assume the knee-chest posture two to three times daily for five to fifteen minutes, and to sleep in a Sims' position at night. A week later, the uterus having been secured in anteversion by the assistance of the knee-chest posture if necessary, fit a pessary large enough and of right shape to hold the uterus from turning over backwards again, and have the patient continue the posture treatment of herself, as before. In the meantime a doctor is able to correct a retroversion — bi-manually should examine the case from once a week to once a month, changing and introducing gradually smaller pessaries, so that the uterus is never permitted by its weight in retroversion to pull upon the idle recuperating round ligaments for about a year, then the case will be cured in a very high percentage of such attempts, — provided that the first six to eight weeks of this course of treatment occur before the physiological period for involution of the uterus and of its members — the round ligaments — is past; after that the cures by pessaries are possibly one or two per cent only.

DR. ROBERT T. GILLMORE: I think prophylaxis in connection with the question of retroversion of the uterus is an important factor, and I am surprised that obstetricians have not recognized the importance of posture in the prevention of retroposition. In the absence of complications of an inflammatory nature, it is well to have the patient lie on the stomach and use the knee-chest position, the sixth to the ninth day after labor. The uterus is usually so big that it will not drop back until after the sixth day. I have done that as a routine measure for the last ten years, and have had very few cases of retroflexion of the uterus after labor. In reference to the use of the pessary after labor, I do not think it should be used for at least five weeks, on account of the possibility of introducing infection.

The point brought up by Dr. Lynch in regard to keeping the cervix back in its normal position in the hollow of the sacrum is very important, and if it is back there we would not have so many retroflexions as we have. Of course, I am speaking now of gynecological retroflexions in which there are always symptoms of some complications that suggest some of the operations for the retroflexion. In other words, there are distinct indications for the use of the pessary; that these indications are clear to every gynecologist and I believe the pessary should be used more frequently than it is by gynecologists. I have had good results in cases of marked subinvolution of the uterus that had gone through labor, by a properly fitting pessary, and by keeping track of those

patients for some years, the uterus had remained in the correct position and the uterus was almost normal in size.

I do not believe in operating for retroflexion unless it produces symptoms or complications such as salpingitis or inflammation of ovaries, or fixation of the uterus backwards in which the adhesions have to be broken up. If there are no adhesions, so that the uterus can be put in normal position, we will get good results from the use of a pessary.

Dr. Louis Fishman: We hear of a good many cases of retroversion that occur shortly after labor that can be benefited by prophylactic measures, by non-operative means. I have seen a number of post-partum cases in Dr. Barrett's clinic that have been treated by the measures outlined here, the knee-chest position, and copious hot douches. There is one thing we have in these cases that has not been mentioned, and that is, we usually have subinvolution of the uterus and all the pelvic organs together with the ligaments of the uterus, and there is a decrease in the weight and size of the uterus by the hot douches and the use of glycerine and ichthyol tampons. If we proceed with these means for from four to six weeks, we can allow proper involution of the round ligaments by righting the uterus with a pessary. Dr. Gillmore raised the question of using a pessary in cases in which we have a freely movable uterus. We know that the uterus favors a malposition. If the malposition is not complicated by some pathologic condition, and produces practically no symptoms, it makes very little difference to the woman whether her uterus is in this or that position, but as a result of retroversion sooner or later there will develop pathology which will call for operative treatment. We know, as Dr. Goldspohn and others have said, a pessary will cure cases that have subinvolution of the uterus plus the pelvic tissues. On the other hand, a pessary will never cure cases that are chronic, that have gone two or three months past labor, because in those all the involution has taken place that will occur, and the pessary there acts as a mechanical agency; to hold the uterus in position we have to use it as long as the patient lives.

Dr. Frank W. Lynch: I fear I have been misunderstood in the use of pessaries. I meant to say, if I did not say so, pessaries after operation, and not after labor. I use a pessary in my cases for six or eight weeks after operation to take the strain off of the sutures.

Dr. William Cuthbertson (closing): I am sorry I did not read my paper. I am very glad Dr. Thompson called attention to the fact that the crux of my paper was in the method of anchoring the round ligament. Every man seems to be satisfied with the operation he does for the cure of retrodisplacements. I agree thoroughly with Dr. Barrett that up to the time I devised this modification the correct operation had not been done. I am very much pleased to hear men of wide experience, like Dr. Goldspohn and the majority of those who discussed my paper, agree that the use of the round ligament is the proper means of correcting these displacements. I will not attempt to reply to the individual discussants, but merely call attention to the fact that I do not anchor the round ligament to the aponeurosis of the external oblique, but I make use of a strip of the external oblique with which to support and fasten the round ligament in its new position. In regard to the trauma of this operation, I have used the Gilliam operation; I used to do ventrosuspension and ventrofixation, and I find that of all the extra-abdominal treatments of the round ligaments, the operation I have reported here causes as little trauma as any of the others in which the ligament is brought forward. Replying to the remarks of Dr. Lynch with regard to the support of the pelvic floor, I have stated in my report of the operation that where the pelvic floor is destroyed, I have repaired it, in order to give the uterus the added support which its natural structure affords it in a normal condition.

BOOK REVIEWS

A CRITIQUE OF NEW BOOKS IN SURGERY

By M. G. SEELIG, M. D., Saint Louis, Missouri

IN a recent issue of *The Nation*, Professor Hiram Bingham of Yale, writing of the late Adolph Alphonse Bandelier, the great American anthropologist, says, "It may have been due to his Swiss ancestry that his literary product seemed to combine German patience and thoroughness, with an originality and brilliance that is French." One wonders what added qualifications Professor Bingham would have attributed to an English strain in Bandelier's ancestry—possibly clarity of thought and force of expression. At all events it will be interesting to note in the books that lie on the table for review (and it happens, accidentally, that French, German, and English ones lie side by side) whether there is a characteristic national flavor as pronounced in type in the medical as in the literary products of these countries.

Der Chirurgische Kursus [1] by Schmieden, would be characterized by anyone as a typical German product, and largely for the reason that it mirrors patience and thoroughness. It is a volume intended solely for the teaching of operative surgery as an art separate and distinct from the science of surgery. There are four hundred pages, divided into eight sections, devoted respectively to ligation of arteries, resection of joints, amputations and exarticulations, operations on the extremities, operations on the head and neck, operations on the chest and trunk, abdominal operations, and operations on the urogenital system.

Written primarily for students, in their work on the cadaver, there is no call for citations from literature or extended discussions regarding the merit or demerit of various operative attacks. Indeed, one of the inherent excellencies of the book is the consummate care with which typical operative procedures are selected and described, step for step, with only those anatomical annotations necessary to the performance of intelligent work. One notes, however, with somewhat of a rude shock, that in describing the radical operation for carcinoma of the breast, Schmieden deliberately (both in his description and in his illustration) places the incision so that it runs directly through the axilla.

No small part of the value of the book resides in the four hundred and fifty-odd illustrations. The Germans of late have adopted a type of combined pencil, crayon, and wash-work illustration which, by the judicious admixture of a little red and brown color and the use of a semiglazed paper, produces a remarkably artistic effect without sacrificing clearness or detail. These very illustrations in themselves furnish evidence of the patient care and thoroughness that we have characterized as Teutonic. From this point of view the volume is an *exemplar*, even though it be not epochal.

NOW the French volume, [2] by way of contrast, mirrors in no sense of the word the brilliancy or originality attributed by Professor Bingham to French literary products. True, it deals with a subject that hardly permits of the display of either of these qualities, but nevertheless it awakens doubts in the minds of those who follow French medical literature of to-day as to whether or not there really exists anywhere in modern French medicine brilliancy and originality even approximating that displayed, let us say, by Charcot, Louis, or Pasteur (himself not a physician).

Lomon and Hahn have treated their subject in three parts. Part I is devoted to the armamentarium of the radiologist and in eleven chapters discusses the properties of the X-rays, the installation of apparatus, the various types of tube supports, tubes, examining tables, screens, intensifiers, and developers. This part of the book is carefully worked out, but, naturally, makes a stronger appeal to the technical röntgenologist than to the clinician.

Parts II and III are devoted entirely to the clinical side of radiology and discuss the interpretation of X-rays of bones and joints, the location of foreign bodies, the examination of the head, chest, and abdomen, and finally the therapeutic application of the X-ray. None of the contents of this second and third part of the volume furnishes new data. For the most part the material is well assembled, but there are omissions so weighty as to lessen the value of the entire work. No mention is made, for example, of ureter catheterization (with an opaque catheter) in locating ureter stones, and the very important subject of diseases of the duodenum is dismissed in four or five lines.

All in all, the book stands rather as an attempt to expound a knowledge of radiology in fairly full compass; but it misses out not only in that the expected French brilliancy and originality play no part in its

[1] Der Chirurgische Operations Kursus. Von Victor Schmieden; Dritte Auflage. Johann Barth, Leipsig, 1914.

[2] Précis de Radiologie Pratique. Par A. Lomon et C. Hahn. Société d' Éditions Scientifiques et Médicales. Paris, 1913.

composition, but also in that there is scanty evidence of the plodding thoroughness that we have learned to look for in good German productions.

THE English volume [1] is true to the English ideal. Although Walker specifically states in the preface that his object is to produce a textbook, his notion of a textbook is so broad —"a book that should reflect current opinion of the day and at the same time bear the impress of the experience and individual views of the author"— that he has succeeded in doing for genito-urinary surgery what Da Costa has done for general surgery with his textbook. When we say that Walker has maintained the English ideal, we mean that he has logically classified his data, carefully sifted it and then presented it with the clearness and force that practically always characterizes good English expository writing. The simple, clear English is reënforced by a wealth of severely plain illustrations that invariably illustrate.

The book is divided into eleven chapters, which discuss in order: kidney, ureter, bladder, urethra, prostate, seminal vessels and Cowper's glands, testicle, tunica vaginalis, spermatic cord, scrotum, and penis. Each subject is introduced with valuable anatomical considerations, important stress is laid upon pathological considerations, and then the etiology, clinical course, diagnosis, prognosis and treatment are described in a fashion that makes good the prefatory promise to outline the individual experience and views of the author. It is always refreshing to find an author saying, "I am opposed to such and such therapy," "I am opposed to" has not the ring of undesirable dogmatism, and it does whet the reader's curiosity both as to the basis for the opposition as well as to what alternate course the author pursues and advises.

As an evidence of Walker's special gift of presentation, we may cite his method of handling the subject of functional tests of the kidneys. In a scant five pages he discusses the subject in such fashion that he presents each functional test and establishes his notion of its practical value. Again, in the case of polycystic kidney, in four pages he furnishes a résumé of this complicated subject that is admirably concrete.

One notes with more or less surprise that under the head of pyelitis in children, the author advises alkalinization, or neutralization of the urine, as the best plan of treatment. This is in marked contrast with the ruling doctrine of the day that hexamethylenamine and an acid urine will practically always effect a cure. One is struck also by the firm stand taken by Walker against washings or instillations in tuberculous cystitis. He demonstrates his poise and judicial temper, however, by furnishing a list of various irrigations that may be used, and among them the five per cent carbolic solution so highly recommended some five years ago by Rovsing.

It is well nigh impossible to practice intensive critique on a volume covering so much ground, and treating so many discrete topics. If we recommend the volume as an almost necessary adjunct to a complete, working surgical library, suggest a bit more care in the next revision of the index and finally add that the author has maintained the English characteristics of conciseness, clearness, and force we shall have stated fairly well our own opinion of the book.

THE prefatory semi-apologetic note which accompanies this volume of the Clinics [2] makes it very evident that, in all probability, both Dr. Murphy and his publishers are beginning to appreciate the generally expressed opinion that it is a herculean task for any one clinic to furnish adequate variety, in published form, every two months. There is possibly an intangible, yet nevertheless a very essential, difference between a clinic as published and as delivered from the pit; but as a matter of fact, even a listener would, in due course of time, surfeit on the steady diet of any one single clinician, however brilliant. Then, too, much of the attractiveness of the published clinics is marred by the form in which they are presented. A sentence such as "that is an entirely different course from that we have to follow" necessarily jars one's equanimity; and composure is not restored by encountering the phrase, "a fracture of both the internal and the external *malleoli*," in one line, and then, on the very next line, "a fracture of both the internal and the external *malleolus*. . . . is a dangerous case" (*sic*).

Yet, withal, the substance is solid. One can with difficulty find elsewhere a better discussion of Pott's fracture than the one published in this volume of the Clinics. It is interesting to note, in this connection, that Murphy persists in his radical advice to nail these malleolar as well as the condylar simple fractures, in spite of the strong protest voiced against these procedures in the surgical section at the last meeting of the American Medical Association.

The clinic on tuberculosis of the testicle is admirably full and satisfactory, and really constitutes about the only new topic in the volume. In this particular clinic Murphy makes the statement that sarcoma of the left testicle metastasizes by the blood route, in contra-distinction to sarcoma of the right testicle, which follows the lymph route. Such a statement should have been accompanied by the citation of authorities.

Dr. Murphy and his publishers promise variety next time, in the form of "a detailed talk on some special topic connected with the general subject of surgical diagnosis." This promise awakens keen anticipation.

[1] SURGICAL DISEASES AND INJURIES OF THE GENITO-URINARY ORGANS. By J. W. Thomson Walker, F. R. C. S., Cassell & Co., Ltd., London, New York, Toronto & Melbourne, 1914.

[2] The Clinics of John B. Murphy, M. D., at Mercy Hospital, Chicago. February, 1914. W. B. Saunders Co., Philadelphia & London.

IN its consistent attempt to correlate pharmacologic actions with physiologic functions the work of Meyer and Gottlieb [1] is unique among textbooks on pharmacology. As the authors state in the preface, they "have divided the drugs into two classes, organotropic (those influencing organs or their functions), and etiotropic (those acting on the causative agents of disease), and have thought it best to describe and analyze the organotropic pharmacological actions separately for each organ or function." The result is that instead of the stereotyped chapter headings of "Aconite," "Bromides," "Caffein," "Digitalis," or "Antipyretics," "Bitters," "Cathartics" "Diaphoretics," we find chapters devoted to the "Pharmacology of the Central Nervous System," "Pharmacology of the Digestion," "Pharmacology of the Circulation," "Pharmacology of the Eye," and so on. For example, the various actions of atropin and its congeners are not grouped together, but are to be found in the chapters on the central nervous system, vegetative nervous system, eye, digestion, circulation, respiratory system, and secretion of sweat. In the treatment of such a confusing subject as pharmacology this method seems ideal, and it has been consistently followed throughout.

The authors have added much to the value of the book by prefacing each chapter with an epitome of the physiology of the function under discussion. These summaries are particularly lucid in the chapters on the vegetative nervous system, circulation, and renal function.

Much work has been done within recent years to determine the extent to which the chemical constitution of a given drug affects its pharmacologic action. Evidences of this are seen throughout the book, perhaps being nowhere more clearly brought out than in the discussion of cocain and its synthetic substitutes.

[1] PHARMACOLOGY CLINICAL AND EXPERIMENTAL. A Groundwork of Medical Treatment, being a Textbook for Students and Physicians, by Dr. Hans H. Meyer, of Vienna, and Dr. R. Gottlieb, of Heidelberg. Authorized Translation into English by John Taylor Halsey, M. D. Philadelphia and London: J. B. Lippincott Company, 1914.

The treatment of such entirely practical subjects as anæsthetics, management of circulatory failure, and diuretics is admirable. There is a thorough presentation of the experimental facts and theories of digitalis action; but this is unfortunately not balanced by a discussion of digitalis therapy in the various clinical aspects of diseases of the heart.

The chapter on "Etiotropic Pharmacological Agents" includes Antiseptics; Anthelmintics; Creosote in Tuberculosis; Quinine in Malaria; Salicylates in Rheumatism; Arsenical Compounds in Protozoal Diseases; Mercury in Syphilis; Tuberculin and Serum Therapy.

In the last chapter on "Factors Influencing Pharmacological Reactions" we find an able discussion of important topics such as Relation between Size of Dosage and Intensity of Effect; Functional Condition of the Organs; Antagonism; Disintoxication; Immunity; Synergism; Hypersusceptibility and Anaphylaxis.

The full index to the volume precludes any criticism of the method of presenting in connection with the various bodily functions the facts concerning a given pharmacologic agent, even though this scatters the facts throughout several chapters.

There seems to be too much of a tendency on the part of the authors to accept without comment the unconfirmed statements of investigators relative to certain drug effects; but this is in many cases corrected by the terse, subjoined notes of the translator, who has here and elsewhere throughout the volume inserted remarks of much practical value. The translator, furthermore, deserves much credit for the evident care with which his part of the work has been carried out.

This book should prove of greatest value to the scientific, thinking physician, who is well grounded in normal and pathologic physiology, and whose experience should prevent his too ready acceptance of of statements of experimental observations or of their reputed clinical significance. The value of the book is further enhanced by a bibliography appended to each subject.

BOOKS RECEIVED

Books received are acknowledged in this department, and such acknowledgment must be regarded as a sufficient return for the courtesy of the sender. Selections will be made for review in the interests of our readers and as space permits.

A SYSTEM OF SURGERY. Edited by C. C. Choyce, B. Sc., M. D., F. R. C. S.; and J. Martin Beattie, M. A., M. D., C. M. Three volumes. Price $7.00 per volume. New York City: Funk & Wagnalls Company, 1914.

SURGERY, ITS PRINCIPLES AND PRACTICE. By Astley Paston Cooper Ashhurst, A. B., M. D., F. A. C. S. Philadelphia and New York: Lea & Febiger, 1914.

A HISTORY OF LARYNGOLOGY AND RHINOLOGY. By Jonathan Weight, M. D. Philadelphia and New York: Lea & Febiger, 1914.

A MIND REMEDY. By John G. Ryerson, M. D. Published by the author.

DE LA NEPHROPEXIE. (Procédé d'Albarran-Marion.) Par le Dr. Jules Luzoir. Paris: G. Steinheil, Editeur; 1913.

PAIN. Its Origin, Conduction, Perception and Diagnostic Significance. By Richard J. Behan, M. D. New York and London: A. Appleton and Company, 1914.

NASAL ACCESSORY SINUSES. Development and Anatomy of the Nasal Accessory Sinuses in Man. By Warren B. Davis, M. D. Price $3.50 net. Philadelphia and London: W. B. Saunders Company, 1914.

THE PRACTICE OF PEDIATRICS. By Charles Gilmore Kerley, M. D. Price, $6.00 net. Philadelphia and London: W. B. Saunders Company, 1914.